March 1957

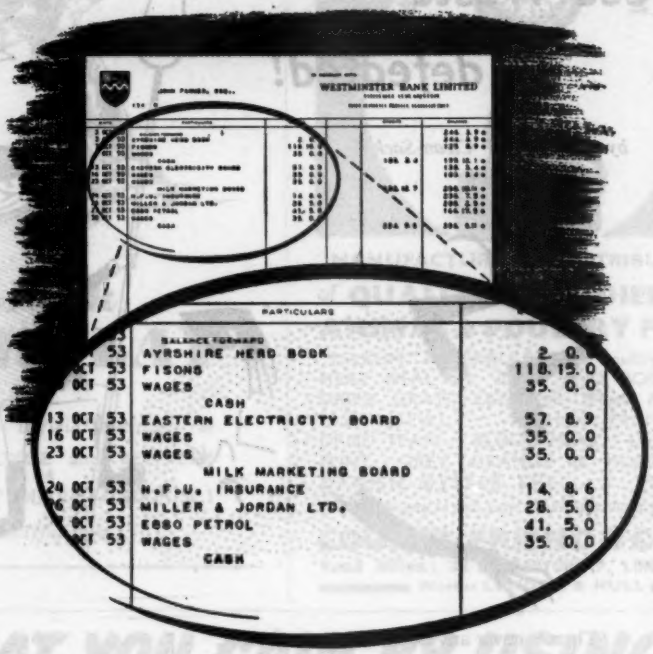
Agriculture

VOL. LXIII - No. 12

"... and suddenly it's Spring"

Published for the Ministry of Agriculture, Fisheries and Food
by Her Majesty's Stationery Office

NINEPENCE MONTHLY

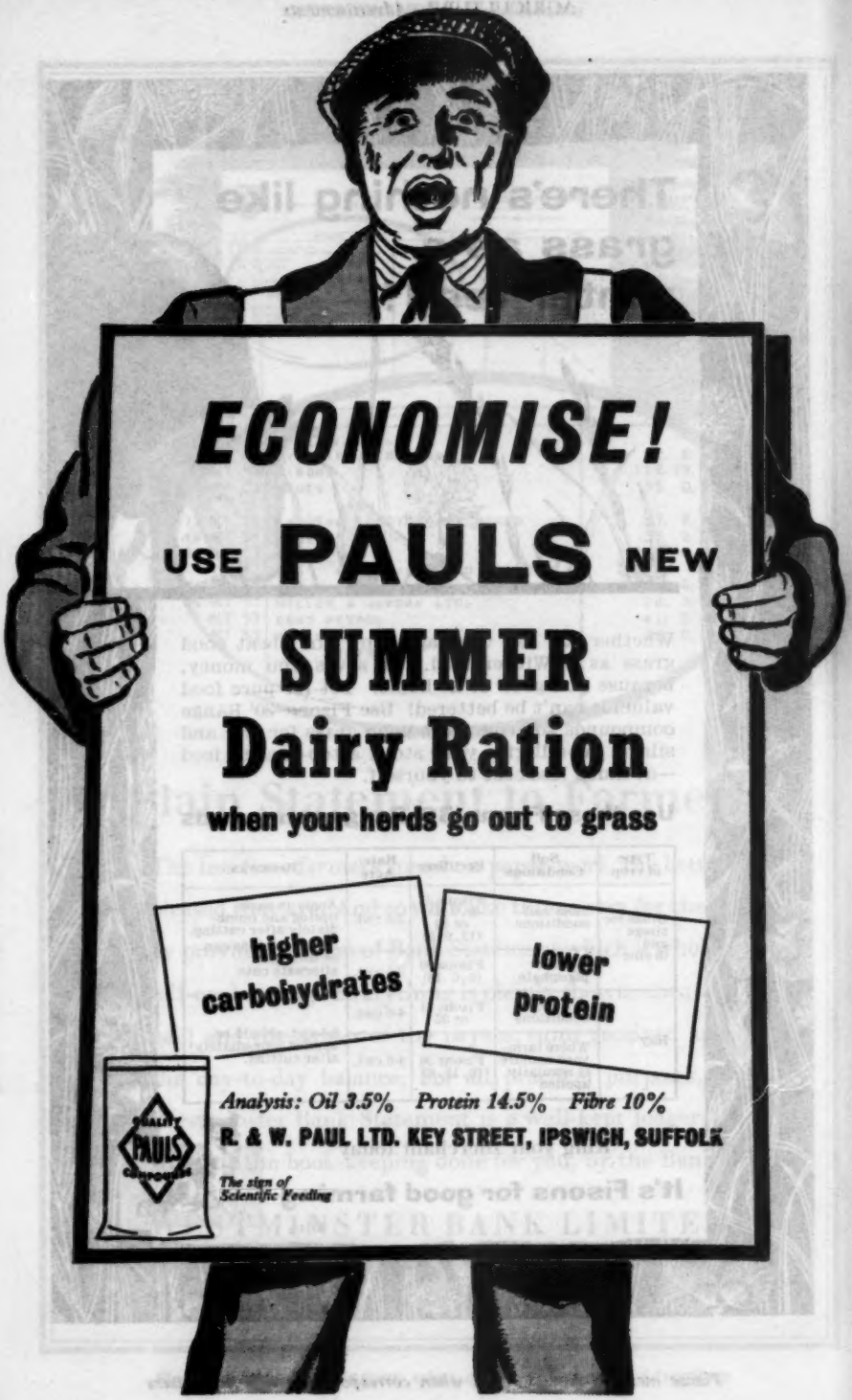


Plain Statement to Farmers

The less time farmers spend on paper-work, the better pleased they are. And so we make things easy for them by providing a form of Bank Statement which is wholly self-explanatory. Everything is plainly shown: cheques paid and the *names* of the payees, sums received and the day-to-day balance. For all practical purposes, a Westminster Bank Statement is a well-kept ledger—with all the book-keeping done for you, by the Bank!

WESTMINSTER BANK LIMITED

HEAD OFFICE: 41 LOTHBURY, LONDON, E.C.2


ECONOMISE!
USE PAULS NEW
SUMMER
Dairy Ration
when your herds go out to grass
higher carbohydrates
lower protein
QUALITY
PAULS
Compounds
Analysis: Oil 3.5% Protein 14.5% Fibre 10%
R. & W. PAUL LTD. KEY STREET, IPSWICH, SUFFOLK
The sign of Scientific Feeding

AGRICULTURE

Editorial Offices: The Ministry of Agriculture, Fisheries and Food,
3 Whitehall Place, S.W.1 (*Phone: TRAfalgar 7711*)

VOL. LXIII No. 12 MARCH 1957

Contents

Cover Photograph

"... and suddenly it's Spring"

AGRICULTURE

VOL. LXIII No. 12 MARCH 1957

HORTICULTURAL MARKETING

R. T. PEARL, M.Sc., A.R.C.S., D.I.C.

National Agricultural Advisory Service

The recently published Report of the Runciman Committee is surveyed, mainly from the point of view of the interest of the horticultural producer. The Committee's Summary of Recommendations has been widely published in the press and is therefore not repeated here.

THE Committee on Horticultural Marketing, under the Chairmanship of the Rt. Hon. Viscount Runciman, was appointed on 31st March 1955 by the Secretaries of State for the Home Department and for Scotland, and the Minister of Agriculture, Fisheries and Food—

> *To investigate the present facilities for and methods of marketing home-produced and imported vegetables, fruit and flowers; to consider whether the marketing and distribution of such produce can be improved; and to make recommendations.*

The Report of the Committee was published on 29th January 1957.*

Main Recommendations The Report proposes no revolutionary change. The Committee considers that the existing system of marketing and distribution, though capable of improvement, could not be supplanted or comprehensively improved by any fundamental change from outside.

Two main recommendations are for the establishment of a

London Market Authority: to create a new North-west London market, to reorganize and reconstruct Covent Garden, and to co-ordinate developments at the other London markets; and a

Horticultural Marketing Council: a permanent organization representative of the whole industry, to undertake development work, including market intelligence, to encourage the use of better marketing techniques, the promotion of publicity, the co-ordination of investigations in the sphere of marketing and distribution, and liaison between the industry and organizations concerned with research and advice. It would be financed by a sales levy.

The central London market premises need improving and modernizing, and Covent Garden relieving of trade with retailers that could be handled elsewhere. Covent Garden could then develop more effectively its proper function as a national produce exchange for price setting and equalizing supplies.

* Report of the Committee on Horticultural Marketing. Cmnd. 61. H.M.S.O., price 6*s.* (6*s.* 4*d.* *by post*).

The Committee does not recommend any general provision of new local markets throughout the country. Markets will develop naturally where the right conditions exist. If created artificially, they might well fail.

A Horticultural Marketing Council would provide the industry as a whole—producers, wholesalers, importers and retailers—with the means to deal together with the problems of marketing from grower to consumer. The Committee does not regard producers' marketing boards as a suitable vehicle for this general development work, particularly as different commodities tend to compete with one another. This proposal would not appear to preclude producers from initiating boards for particular commodities.

Criticism of Present System Produce is said to pass through too many hands, but the great diversity of perishable commodities, unpredictable in quantity from day to day, necessitates a flexible, if complex, system. Under it, distribution is wide and rapid at costs that compare not unfavourably with those in other industrial countries and in other distributive trades in this country. Assembly and sale must take place at major centres of communication, and the fact that imports are nearly as substantial in value as home-grown commodities reinforces this argument.

Most of the criticism of marketing arises at times of glut or shortage. Attention is then focused on one or two commodities, and others in reasonable supply and at fair prices are forgotten. Production and demand are both largely influenced by the weather, and there are bound to be gluts and shortages, and public criticism, however unreasonable, of them. The heaviest risk and the greatest uncertainty must be the growers', and it is unrealistic to expect it to be shared.

Growers who plan their production and prepare their produce to suit the particular markets with which they deal are on the whole not dissatisfied with their returns. Those whose marketing is casual tend to be the critics.

There is little scope for growers to increase their earnings at the expense of distributors. Conversely, there are no easy pickings to be got by growers entering the wholesale trade, and they must be left in no doubt about this. There is not always the confidence between growers and salesmen that is essential to a system of commission selling. It could be fostered through the setting up by the wholesalers themselves of an Institute of Salesmen with disciplinary powers.

There is room for increased consumption of horticultural produce, particularly the choicer types. The housewife seems ready to spend if she can get convenience with quality. Pre-packing and self-service retailing are likely to extend. Publicity, directed towards instructing the industry and informing the consumer, should lead to better service and increase the consumer's interest and with it her purchases.

Market Intelligence Improved intelligence services would enable large operators to plan supplies better, and would help to regulate international trade. Nearer home, the grower could judge better whether he was getting reasonable receipts for his produce. It would, however, be dangerous to attempt to use day-to-day market intelligence to "chase the market", since this tends to unsettle smooth working and to accentuate gluts and shortages.

Standardization The greatest scope for changing the system of marketing is in the field of better graded and packed produce. It is mainly good growers who grade for quality, and it may not pay the less good

to do so. Probably, the first step among the less skilled should be to improve standards of production, rather than to promote grading alone. Nevertheless, there is a demand for cheap ungraded produce which should be met.

Maintenance of grade standards is feasible where high transport costs are the rule or where produce is channelled through a few outlets as with exports. In this country such conditions do not exist nor could they develop quickly. The Ministry's recommended grade standards and grade assessment schemes are of educational value and should be extended.

There are still far too many types of containers. Greater uniformity would facilitate bulk handling and the fullest use of mechanical methods. The replanning of market premises is linked with container standardization. Dimensions and capacity should be prescribed and all returnables required to conform to them. The design and economics of containers merit further study.

Produce in standard containers and certain pre-packed produce should be exempted from sale on a statutory basis of weight.

Growers' co-operatives have developed in some parts of the country, but there is a limit to the natural increase of their numbers. Success is most likely where there is a close community of interest, proximity of members, a substantial stake by every member in the capital investment, and a common commodity, particularly one that can be held in store. The element of compulsion in the Land Settlement Association's co-operative scheme accounts for much of its success, but it works under quite exceptional conditions.

An Impressive Reference Work Quite apart from its conclusions, the Report provides a clear and masterly survey of the system of horticultural marketing in all its aspects. It is of great educational value to growers, advisers and teachers engaged in horticulture and to students preparing to enter the service of the industry. It is likely to remain a standard text-book on these matters for some time to come.

BETTER MANAGEMENT—LOWER COSTS

OXFORD FARMING CONFERENCE, JANUARY 15-16, 1957

L. W. TOLLADAY

Ministry of Agriculture, Fisheries and Food

The Eleventh Oxford Farming Conference attracted an audience of well over 450 to discuss the important part which management can play in lowering costs. The following brief summary touches upon some of the major points made by speakers.

NOT unexpectedly, the recent Government announcement on long-term guarantees and capital improvement grants dominated the Oxford Farming Conference. As it turned out, the conference was well timed, for although the news was still fresh in farmers' minds, sufficient time had elapsed to permit of mature consideration of its implications. And to judge from the general air of guarded optimism, it seemed that this latest evidence of the Government's continued faith in agriculture had made a most favourable impression.

BETTER MANAGEMENT—LOWER COSTS

The theme of the conference—"Better Management—Lower Costs"—could not have been more apt. As MR. W. FREUND, an Oxfordshire farmer, put it, "this might well be the motto of the whole agricultural industry at the present time". He recalled that the Minister of Agriculture had, in his speech at the Farmers' Club, put the main requirements of the industry as capital, confidence and good management. "The White Paper has dealt with the first two factors," he said; "it is now the job of the farming industry to deal with their side of the bargain. And in no industry I know is managerial skill so important and so individual as it is in farming."

The problem of capital has not, of course, been solved by the proposed capital grants. Capital is short the world over, warned Mr. Freund, and it is unrealistic to look for subsidized interest rates for our agricultural borrowing. Nor should farmers rely upon short-term borrowing from the banks to meet their share of the cost of improvements, which are long-term projects. In the absence of investment allowances ("to be allowed to borrow some of our own profits"), it is to be hoped, said Mr. Freund, that the long-term assurances will produce enough confidence to encourage the farming community to convert some of their savings to working capital.

It was obvious that this question of how to find the farmer's share of the cost of the new buildings was in the forefront of many minds. MR. F. H. GARNER (Cambs) pointed out that those who need capital most often cannot get it, and he put in a plea for interim payments on the proposed new grants as the work goes on. But MR. K. RASMUSSEN (Nottingham University) was thinking on different lines. He suggested that one million of the £50 million would be better used to provide a farm building research institute.

In contrast to Mr. Freund, MR. P. SUTCLIFFE (Devon) took a longer-term view and, in particular, analysed the effect of size, layout and present tenure systems on efficiency. Unlike the main areas of overseas competition, he pointed out, our farms were fashioned in the main when brawn and horsepower were dominant, and thus they are comparatively small and ill-adapted to utilize to the full the newer agricultural techniques.

Mr. Sutcliffe was particularly gloomy about the landlord-and-tenant system: "It has been gradually breaking down over the last century, and now may be said to function very sluggishly—if at all." Roughly 60 per cent of our farms operate under the landlord-and-tenant system, and, suggested Mr. Sutcliffe, probably no more than one-sixth of the landlords can and are performing their proper function as land managers. Assuming that one-quarter of owner-occupiers have adequate capital, we arrive at the conclusion that 80 per cent of all farms are inadequately provided for in the matter of fixed capital equipment. "The Government's new proposals may go some way towards alleviating the dearth of capital," he said, "but it is hard to see that it is going to make landlordism an attractive investment proposition." There is no panacea for the situation, suggested Mr. Sutcliffe, but he thought we might well look at what is being done in New Zealand, the U.S.A. and Sweden in the way of supervised loans, "share farming", and the compulsory purchase and reallocation of small and inefficient farms.

Farm Buildings and Efficiency MR. FRANK SYKES (Wilts) and MR. H. HOLLINRAKE (A.L.S., Cambridge) were concerned with the contribution which farm buildings can make to labour efficiency. As they both pointed out, many of our farm buildings are a hundred years old; and while perhaps this mattered little before the war, when labour was cheap and plentiful, we can afford them no longer.

Mr. Sykes came down very heavily against the general-purpose building. "I believe in a specialized building . . . and I would sooner wait a year to accumulate capital . . . than erect a cheaper building which will either become an agricultural slum in a very short time or fail to wring that last 5 per cent of efficiency of which the stock are capable." He suggested that three principles should guide the farmer: seek professional advice to ensure good, labour-saving buildings; allow time for design and erection ("a year to plan and a year to build is not too long on a major new enterprise"); build well and avoid making do.

Mr. Hollinrake approached the subject from a different angle. Along with modern building techniques, new materials and a better understanding of stock requirements, we must, he said, study our methods of doing a job and the relation that one building has to another. Work study is the term used for this, but unfortunately it tends to go astray in its application. Thus we concentrate on trying to save fractions of seconds in matters of detail, ignoring the far larger savings that may result from considering the layout and method of using the buildings as a whole. "Save the minutes by all means," he said, "but save the hours first." To grasp fully the ebb and flow of work around farm buildings, suggested the speaker, make a diagrammatic study of farm traffic. Divide it into the two main groups—permanent and transitory. The first on a stock farm will include all aspects of animal keeping, as foods (imported and home-produced), dung traffic, milk traffic, etc.; the second takes in all the items that are merely stored on the farm, as fertilizers, produce for sale and implements. Having done this, separate these groups and bring together the buildings that have some work relationship. Then, and only then, he maintained, should the movement of labour be considered.

It was obvious that MR. BRIAN BRANSTON (B.B.C.) regards himself as a voice in the wilderness when it comes to converting the farming community to time-and-motion studies. He had, he explained, already written and talked on the subject for ten years with the most meagre results. There are some baffling obstacles to the promotion of efficiency—among them, human nature and the comparatively low take-home pay of the farm worker. But time-and-motion studies can promote spectacular savings, he claimed, as in the classic American example in 1942. There, on a dairy farm with a milking herd of only twenty-two, simple changes in the byre saved four months' work and 730 miles walking a year! And this was achieved with very little capital expense and few structural alterations.

Organizing Labour Good management, defined simply, is the ability to organize well, and perhaps the best way to improve your organization is to study how a successful competitor runs his business. Thus MR. F. W. DEPTFORD (Cambs), who farms 1,100 acres of mainly arable land near Wisbech, was assured of wholehearted attention. He pointed out that modern farming methods have revolutionized tasks like seeding and weed control, so that on a good many arable farms, farmers and their men are literally idle for eight months of the year and overworked for the rest. The answer, he said, is a planned and balanced system to avoid too many crops clashing at peak periods. Do not waste money by buying machines to help with work where there is no congestion at any stage: and plan for an early start, for there is no greater source of loss on the farm than being behind with the work. It pays, continued Mr. Deptford, to keep the labour in small gangs, for their speed is that of the slowest worker: "for example, eight good potato pickers will pick 2 acres a day, but it is rare that twelve pickers will pick 3 acres". Payment by results was also advocated by

Mr. Deptford, but only at peak periods. "We use piecework from July to October," he said, "and the men work to the limit of their capacities, but they are very tired at the end of it."

Finally, Mr. Deptford sounded a note of warning about the loss of regular workers from the land. "We must plan ahead to find methods of encouraging men to take up agricultural work . . . we must forget all about living on lonely farms. I strongly advise farmers not to build or improve cottages in lonely places; it is better to buy or build houses in the village, for in ten years' time the womenfolk will insist on staying in the towns and villages."

But although the housing of men in the village may be all very well for the arable farmer, it is rarely satisfactory for the livestock man. The solution to the problem offered by MR. A. A. COPLAND (Somerset) was to get the men to feel themselves as part of the farm organization—"the 'our' and 'we' approach," as Mr. Copland termed it. "You cannot get men to give of their best unless you get them really interested," he said; "and you must set up a challenge to their ability."

It is not enough, said Mr. Copland, merely to keep a board in front of each cow to record her weekly yield, calving, stocking, etc. "I want to know that the herdsman looks at the milk register frequently, like a doctor looking at the chart of his patient, so I ask for a separate list every week, showing weekly weighings, dates of calving, service dates, and any general remarks about fitness, etc. This information is of very great help in organizing our business . . . but there is another reason for it—you cannot sit down and write up the milk register and list without thinking about your homework. We all get interested; it becomes *our* herd; and as a result we get more milk, better cows and more respect for one another."

Unlike Mr. Deptford, MR. JOHN YOUNG (Norfolk), who farms 580 acres of light sandy soil over chalk and 180 acres of reclaimed siltland, nearly all of it under the plough, proclaimed himself a supporter of piecework at all times. "I believe in giving the maximum opportunity for men to earn above-average wages, and that the best way to do this is by working as much piecework as possible. I regard it as my responsibility to be able to set men to work profitably. I do not believe in bonuses based on farm profits: they are too indirect and too slow, and tend to be regarded as a gift. They are impossible to work fairly on the equivalent effort of each man on a mixed arable farm."

Mr. Young's recipe for profitable farming on his type of soil can be summarized simply as: sound rotations; a simple system (a minimum number of enterprises, only one compound fertilizer, one variety of wheat or barley); good management; and having the courage of your own convictions. "A well-planned rotation," he maintained, "offers great scope for simplifying the economical running of a farm and allows maximum time for all seasonal work. It keeps the land free from soil-borne diseases and makes for bigger yields."

Cash Crops and Stock The livestock enterprises on Mr. Young's farms (cattle and sheep) are more or less self-contained. Nothing is ever bought for the 60 cows, and their winter diet consists of beet tops, white turnips, pea-haulm silage and straw. They live outside all the year round and rear only their own calves. The ewe flock of 260 follows a similar cycle, with beet tops in the autumn, followed by turnips until March. Mangolds are then fed to them on the leys until after lambing. Beet pulp is taken as required for the indoor cattle and sheep. The only other bought

feedingstuffs are a balanced mixture for the sheep and a few nuts for the smaller calves after weaning.

The last speaker, MR. R. ROADNIGHT (Oxford), who described himself as an optimist in the centre of England farming on the left-overs of others (the unwanted rain from the west and the remnants of the sun from the east!), very soon demonstrated that his system was based on more than optimism. With Mr. Young, he was all in favour of large-scale cash cropping. "Our principle is a cash crop from every acre every year," he said. But even so, half his turnover comes from livestock.

Mr. Roadnight farms his 2,200 acres on an eight-course rotation of wheat-barley-barley-clover-wheat-barley-barley-roots and rape (for seed). Cocksfoot and other herbage seeds are also taken in the fallow break. The farms are organized in blocks, so that, for example, all the wheat comes in one block, thus keeping all the autumn work together. Comparatively heavy dressings of fertilizers, amounting to about £6 per acre (excluding subsidies) are given. The buildings on each farm are allocated to a special purpose. Thus the home farm is all grain drying, cleaning and storing, another is given over to calf rearing, a third carries the weaned stock, and so on. The most central farm is used as a base for all the tractors and implements. But Mr. Roadnight is no supporter of the complicated repair shop. "It is better to use your machinery hard and swop it out rather than take it to bits too often," he said.

Although he did not go in for stock until after the war, Mr. Roadnight now rears 250 Friesian heifers a year, has a flock of 400 ewes, a herd of 100 sows (which are run like a flock of sheep and were introduced to give the shepherd full employment), and produces 7,000-8,000 pullets from an accredited flock every year. His aim in introducing stock was, he said, to double the turnover on the land and still maintain the arable output (then £25-30 per acre). Last year he did better than this by achieving approximately £60 per acre.

Great emphasis was also laid by Mr. Roadnight on the team spirit. "When the stockmen are busy, the tractor men will help with the pigs and cattle," he said, "and during harvest nothing is allowed to stop. The stockmen spell the combines for meals, and the vermin destroyer keeps the drier going all night." But no doubt a good deal of the credit for this outstanding spirit can be attributed to the incentive bonuses which he pays. They apply beyond a fair mean to all the farms' enterprises. But, it should be noted, they are not entirely one-way: to temper high output with care, there is also a penalty for losses.

A full report of the proceedings will be available about April from the Hon. Secretary of the Conference, Mr. M. H. R. Soper, Department of Agriculture, University of Oxford.

Corrections (February issue)

Agriculture in the British Economy (p. 462)

We regret that Professor D. S. Hendrie was misreported as saying that he saw no objection to the freezing and chilling of home-killed beef to smooth out the autumn flush. His remarks referred only to *chilling*, not freezing.

Early Stages in Ley Establishment (p. 511)

The years 1956 and 1955, shown in the table, should read 1955 and 1956.

SPRAYING TO CONTROL WARBLE FLY

D. STEWART MACLAGAN, F.R.S.(ED.), D.SC., PH.D.
West of Scotland Agricultural College

Internal treatment is probably the ideal way of controlling Warble fly, but until a suitable chemical is found, the experimental results so far available suggest that preventive spraying may well prove worth while as a supplement to present routine measures.

UNDER the terms of the Warble Fly (Dressing of Cattle) Order, 1948, it is incumbent upon the owner or person in charge of cattle that are visibly infested with the larvae of these flies to dress such animals with a freshly prepared derris wash of specified strength. The law requires the dressing to be applied within seven days of March 15, or as soon as the warbles appear on the back; and it must be repeated at intervals of not more than 32 days until June 30, or so long as the maggots continue to appear, whichever is the earlier. Despite the considerable success of this type of treatment in Britain, on the continent of Europe and in America, progress in reducing the number of warbled hides is still disappointingly slow. It must, of course, be borne in mind that we in Britain are at some disadvantage, compared with continental Europe—for example, we have no free supply of derris preparation, no official "de-warblers", and vast seasonal movements of store cattle. Apart from these and other difficulties which militate against the efficiency of the treatment in practice, there are ecological factors which may render control, by means of derris washes, less effective or slower in operation here than elsewhere. For instance, the complexity of biogeographical regions and the notoriously variable climate of Britain tend to lengthen the period during which derris washes must be applied to prevent most of the maggots escaping from the backs of the animals.

Thus Warble fly larvae may be found in the backs of cattle from late January until early August[1], depending on the district and the species. According to Schwardt[2], at least five applications of rotenone are needed to give anything approaching good control of these pests when both species, *Hypoderma lineatum* Vill. and *H. bovis* Deg., are present; and the resistance of the latter to rotenone is such that the kill seldom exceeds 80 per cent[3]. Even poorer results were obtained in California[4], for larvae considered dead by field examination proved to be alive when warmed in the laboratory. Recently, an investigation concerning the incidence of open warble holes in the hides of all cattle slaughtered in Scotland during the year ended February 28, 1953, revealed that, whilst May and June were the peak months, slightly more than 10 per cent of the hides had open warble holes as early as February and as late as September. The corresponding figures for July and August were 25 per cent and 20 per cent, respectively. In view of these various findings, therefore, and taking the whole of Britain into consideration, it seems that the problem of controlling warble infestation may be more difficult and slower than was originally expected. Present indications are, in Scotland at least, that an undesirably large proportion of larvae find an escape gap from control during July.

The ideal solution of the problem would be one or two insecticidal treatments by way of internal medication, but until a suitable chemical is found (see p. 566) a supplementary method of hastening the eradication of *Hypoderma* would be by preventive spraying. With this objective in view, several interesting experiments have been carried out in different countries. Un-

fortunately, attempts to break the life-cycle of the Warble fly by this method have had variable results, but for that reason it seems worth while to review these experiments and, if possible, to account for their conflicting evidence.

Trials in America and Britain The first experiment of this kind, using the new chlorinated hydrocarbons, was made in America by Matthysse[5], who tried to prevent warble infestation by using various sprays of DDT, applied to the legs and undersides of cattle *before* the animals were turned out to pasture. He concluded that the sprays were of no value—not surprising in view of the injudicious timing. For the first attempt in England[6], heifers were sprayed weekly from May to September with gamma-BHC (0.1 per cent) to give a deposit of 3 grammes of insecticide per beast. The following year there were as many warbles on the treated animals as on the controls. On the basis of these results, it was considered that an effective concentration of this insecticide would be economically impracticable, but costs are now lower and improved formulations ensure better persistence on hair. In Texas, cattle were sprayed with several insecticides at different concentrations every second week from January until the end of April[7]. One animal from each sprayed group was killed on May 4, and larvae were found in the gullets of all, except the cow that had been sprayed with crude BHC (2 per cent). Experiments in Wales with an emulsion spray of DDT (1 per cent), applied three times from July 18 to August 18, resulted in a 65 per cent reduction of infestation by the larvae of *H. bovis*. Interesting possibilities are envisaged by an American worker[8], who found that a preparation of pyrethrins (1 per cent) and piperonyl butoxide (10 per cent) applied to calves by treadle-sprayer at the entrance to the watering area, controlled oviposition by *H. lineatum* but not by *H. bovis*.

I myself have carried out a pilot trial of preventive spraying in collaboration with the agricultural adviser for Dunbartonshire. Nine Ayrshire heifers were sprayed on July 8, 1952, with an emulsion of DDT (3 per cent); another nine heifers, in the same field, served as controls. Treated animals received fully ¾ pint of fluid in the form of a fine mist-like spray, on the flanks, belly, legs and escutcheon. This is a fairly heavy dosage of insecticide, which, in view of the results given below, would have been better applied twice at half the concentration. But we were primarily interested in determining the effects of one heavy treatment, given at a particular time, since a previous investigation[9] had shown a strong correlation between the percentage of warbled hides and the hours of bright sunshine during the preceding July.

Nine Sprayed Heifers
(in order of Warble fly infestation)

Examined 1953	No. of New Warbles								
Mar. 17	0	0	0	0	0	0	0	4	9
„ 31	0	0	0	0	0	0	0	1	0
Apr. 14	0	0	0	1	1	1	2	0	0
TOTAL PER BEAST ...	0	0	0	1	1	1	2	5	9

Nine Unsprayed Heifers
(grazed with the sprayed animals)

Examined 1953									
Mar. 17	0	0	0	1	2	0	7	3	2
„ 31	0	0	0	0	1	6	2	7	7
Apr. 14	1	1	2	3	5	5	2	3	5
TOTAL PER BEAST ...	1	1	2	4	8	11	11	13	14

These results show a 66 per cent reduction in the number of animals infested with more than two warbles, and a 70 per cent reduction in the average number of warbles per beast.*

Trials in Germany and Russia German investigators have also been interested in preventive spraying. In experiments with emulsion sprays of BHC (concentration not stated), cattle on mountain grazings, where both species of *Hypoderma* were present, received eight treatments between July 28 and September 15, and were examined for warbles in the following year[10]. The average number of warbles per beast did not exceed 3.7, as compared with 9-12 in neighbouring untreated herds. In another trial, involving five sprayings between July 30 and September 3, the mean percentage reduction of warbles in the following April varied from 63.8 (calves) to 98.0 (yearlings). This is a remarkable decrease, despite the late timing of the first application.

Russian workers have conducted similar trials against the Warble flies of cattle and reindeer. Field trials near Leningrad included an attempt to control the adult flies by means of a 5 per cent spray of DDT. The cattle were treated at 15-day intervals during July and August by driving them through the cloud released from two knapsack sprayers on either side of a gate. It is claimed that counts in the following April showed great reductions in the number of warbles per beast, as compared with the controls and with the same herds in the previous year[11]. It is suggested that the reduction of infestation was not due to the death of the newly-hatched larvae but to prevention of egg laying, since the flies died after contact for two seconds with pieces of hide lightly smeared with 2-10 per cent DDT in solar oil.

More recently, good results have been claimed for a combined DDT-BHC spray against Reindeer Warble fly (*H. tarandi* L.) in Murmansk. A herd of 3,200 reindeer was treated six times between July 20 and September 1, 1953. Application was from a hand-operated pump through two nozzles attached to a long pole, thereby enabling two men to complete the job in two hours. The spray consisted of fine droplets of DDT and BHC, every animal receiving about 0.1 oz of each toxicant. But BHC was regarded as having little additional effect[12].

Internal Treatment The latest approach to the problem is by way of internal medication, with the objective of killing the migrating larvae before, or as soon as, they arrive in the subdermal tissues of the back. American workers have found that several organo-phosphates, including diazinon and chlorthion, killed the larvae of *H. bovis* in the back at the time of oral administration, and prevented the appearance of fresh warbles for 2-3 weeks[13]. They conclude, however, that a systemic insecticide of sufficiently low mammalian toxicity to allow an adequate margin of safety in general use by farmers, has not been found. Phenothiazine—better known as an anthelmintic than as an insecticide—has given conflicting results, but they are sufficiently important to warrant further trials. In Ireland, cattle were dosed from November to March with phenothiazine, hexachloroethane and "Hypolin", but none of these treatments was effective against the larvae of *H. bovis*[14]. This is contrary to the findings of Worden[15]. The latter's results are also supported by American field trials in which calves, that were allowed free access to a phenothiazine-mineral mixture, harboured 60 warbles over a period of two years, as compared with

* Analysis by "t" test shows that these results give 19 to 1 odds of statistical significance, but if the first count is excluded on the legitimate assumption that some oviposition occurred before the animals were sprayed, the results are highly significant, at odds of 99 to 1.

298 warbles in similar groups of calves under identical conditions, but allowed only the mineral mixture[16]. However, the larger of Schwartz's two experiments involved only twelve animals—six medicated and six controls—and he admits that the data presented "are only indicative and not conclusive". Although it is conceivable that a phenophthiazine metabolite might exact a toll of mortality among the larvae during their migration through certain tissues of the host, the verdict on the available evidence must therefore be "not proven".

Glimmerings of Success Warble flies are now recognized as the major pest of livestock in the United States. The problem of controlling these flies, with a view to their ultimate eradication, is engaging the attentions of many research workers not only in America but throughout Europe, for despite the valuable results which have accrued from the generally accepted treatment of cattle with rotenone-containing washes, scientific and practical considerations are limiting the speed at which the ultimate goal can be achieved. However, within the last decade the advent of new pesticides has increased the potential methods of dealing with this ancient problem, particularly along the lines of preventive spraying as a supplement or possible alternative to accepted routine measures.

Viewing the aforementioned researches in retrospect, it is apparent that the diversity of opinion concerning the effectiveness of the sprays arises from differences in formulation, concentration and toxic ingredients of the various preparations; and, in a few instances, from injudicious timing of the application. The protective action of DDT is obviously superior to that of BHC, presumably through inhibiting one or more of the series of reflexes involved in oviposition, as in *Lucilia* species of the sheep blowflies; which are, conversely, more susceptible in the larval stage to BHC than the adults. Modern sprays, based on micro-crystalline ingredients and cationic wetters, ensure a heavy deposit of the toxicant on hair, and with the advent of highly persistent insecticides such as dieldrin and diazinon, these new formulations are heralding a new era in preventive spraying. In relation to the Warble fly problem, a spray which would inhibit oviposition for five weeks (or a really effective food-medicament) would reinforce or perhaps replace existing methods. In fact, the glimmerings of success are just visible.

On going to press, a short account of recent American work with an organophosphate insecticide has been observed in *Agricultural Research*, U.S. Dept. Agric., July, 1956. This chemical, ET-57 is systemic in action and, it is claimed, when fed to infested animals, kills the larvae wherever they are situated. Tests are in progress to determine the effects of residues in flesh and milk. Workers at the Agricultural Research Service laboratory (Corvallis, Oregon) are hopeful that ET-57 may be the ultimate answer to Warble fly.

References

1. W. J. Bevan and E. E. Edwards. *Bull. ent. Res.*, 1951, **41**, 639.
2. H. H. Schwardt. *Agric. Chem.*, 1950, **5**, 87.
3. D. K. Scharff. *Bull. Mont. agric. Exp. Sta.* No. 471, 1950.
4. D. P. Furman and J. R. Douglass. *J. econ. Ent.*, 1948, **48**, 783.
5. J. G. Matthysse. *J. econ. Ent.*, 1945 **38**, 442.
6. K. Unsworth *et al. Ann. trop. Med. Parasit.*, 1947, **41**, 262.
7. O. H. Graham. *J. econ. Ent.*, 1949, **42**, 837.
8. E. S. Raun. *J. econ. Ent.*, 1955, **48**, 603.
9. D. S. MacLagan. Doctorate Thesis, 1936, Edin. Univ. Libr.
10. R. Kühl. *Anz. Schädlingsk.*, 1949, **22**, 185.
11. D. V. Savel'ev. *Parasit. Sborn.*, 1952, **14**, 103.
12. K. A. Breev and D. V. Savel'ev. *Veterinariya*, 1954, **31**, 35.
13. W. S. McGregor *et al. J. econ. Ent.*, 1954, **47**, 465.
14. J. E. Kenny and T. O. Nuallain. *Irish vet. J.*, 1955, **9**, 148.
15. A. N. Worden. *Vet. Rec.*, 1953, **65**, 586.
16. B. Schwartz *et al. Vet. Med.*, 1954, **49**, 405.

PROBLEMS OF LAND OWNERSHIP

A CONFERENCE AT PRESTON

R. F. SMITH, F.A.I.

Agricultural Land Service

It was obvious from the recent conference at Preston that the announcement of the proposed capital equipment grants has stimulated considerable interest among landowners in the major problem of improving farm buildings.

"WHEN considering the improvement of fixed equipment on any particular farm, it is as well to make a survey of the existing layout so that the relationship of the various buildings can be fully appreciated: in any case, it is so much easier to tear up paper than pull down bricks and mortar." So said MR. R. W. CHADBURN, an agricultural consultant, speaking at a one-day conference on landownership problems, held at Preston, Lancs on December 6, 1956. The conference, which was organized by the Agricultural Land Service in co-operation with the County Landowners' Association and National Farmers' Union, was attended by about 150 landowners and agents.

It is necessary, pointed out Mr. Chadburn, to give dispassionate consideration to the cost of improving old buildings, as compared with the cost of providing new; the burden of future maintenance must be considered at the same time as the capital required for a new building. Old stone buildings, in particular, need careful thought, since it will often be found that the cost of making good structural weaknesses and breaking through masonry to form new door and window openings will bring the cost of adaptation very near that of a new building. That is why he advised landowners to stop and think. For example, on occasions the lowering of a roof is to be commended to avoid expensive repairs to a loft floor. It may also be advisable to disregard current usage of existing buildings so that an entirely new "circulation system" can perhaps be evolved. While this idea should not be taken to the extreme, it may reveal how a significant saving of labour might be achieved.

The opportunity seldom occurs for wholesale demolition, said Mr. Chadburn, and in most instances an owner will need to compromise by reconstructing, adapting, and adding to his equipment. Before undertaking any improvement work, it is as well to find out whether certain fundamental requirements are fulfilled in relation to siting—for example, drainage, water supply, position of the building in relation to the farm as a whole, fall of the ground, access to fields and hard roads. If the majority of these points can be satisfied, then it is worth studying the improvement of the old building in greater detail; if not, the question of providing a new building will need pondering but again the basic siting principles must come into play.

Milking Premises Mr. Chadburn urged owners not to be discouraged by the attestation requirements. When dealing with old timber-framed structures, he felt that many difficulties could be overcome by avoiding the use of timber at the low levels and ensuring that surfaces likely to be soiled can be kept clean. There has been much discussion on the relative merits of cowshed versus yard-and-parlour, and the verdict in any particular case must depend upon such factors as climate, availability of litter, and suitability of existing buildings. An increasing number of farmers

are milking in parlours, the cows being accommodated in existing cowsheds (which may not be capable of improvement at reasonable expense), or housed in yards, where a measure of controlled feeding is achieved by multiple cow-ties. He thought that it is often cheaper to form a convenient yard-and-parlour layout from a set of old buildings than provide an entirely new cowshed.

As calves are closely associated with milking stock, their accommodation should be near both the cowhouse and meal store; if bucket feeding is practised, the sterilizing room should also not be too far distant. Calves must be kept warm; the use of insulation material in floor and roof construction will go a long way to achieve this, and the additional cost involved is relatively small.

The conversion of existing buildings for pig fattening was considered by Mr. Chadburn to be both expensive and difficult. Modern pig production is a highly specialized enterprise, and it is rare to find a building which can be made suitable without costly alterations. Questions of insulation, ventilation and temperature are of paramount importance in pig housing, and it is unlikely that economic pig production will be achieved in buildings that are basically unsuitable for the purpose.

Grain Storage Mr. Chadburn sounded a note of warning to those contemplating adapting old buildings for grain storage, and urged landowners to resist the temptation of storing bulk grain in buildings not designed to take the thrust thereby imposed. "Do not be taken in by a good-looking large barn and think you can adapt it into grain bins by erecting a few walls," he said. Great care is needed in building inside walls in a barn and tying them with the outside walls, and there is a lot to be said for using pre-fabricated bins which are scientifically designed to take the stresses and strains which develop. They may, in some instances, be more costly, but will usually stand the test of time. In planning a system of grain storage and handling it is as well to give careful thought to layout, as all too frequently adaptations bring in their train high handling charges which, over a period of years, may exceed the cost of a new building.

Some discussion took place at the conference on the merits of the "umbrella" type of building. Mr. Chadburn felt it has much in its favour, particularly if the fall of the ground can be used with advantage in providing both single and double storeys under the same roof. Farming methods and requirements are liable to change fairly quickly, and it is of some advantage to have portable divisions which can be altered to meet changing needs.

Financial Aspects In his paper on "Financial Implications of Estate Management", MAJOR K. A. CLARK, of Staindrop, Darlington, drew attention to the necessity of keeping economic considerations clearly in mind when embarking on improvement schemes. First and foremost, he said, we must be sure that the capital will bring in a good return, either by increased production or reduced labour costs, or both. The next consideration is whether the tenant is prepared to pay a higher rent which will give the owner a fair return on the capital invested. The increase should be related to the extra profit the tenant will earn. When an improvement scheme has been decided upon, Major Clark recommended that the rent of the farm should be re-assessed, instead of calculating the additional rent as a percentage of the capital cost. Even so, the prudent landlord will have to bear in mind the interest he will pay on borrowed money (or the interest his own capital would earn if invested elsewhere), as well as the sinking fund which would be created to replace the building at

the end of its useful life. He thought a landlord should normally expect a gross return of at least 7¼ per cent, and if this could not be obtained, the scheme should be subjected to further scrutiny since it would scarcely be worth while.

It is also necessary, pointed out Major Clark, to consider how the work is to be financed. On some estates non-agricultural investments can be realized for this purpose, but most owners will need to secure capital by other means. Landlords, in general, will be aware of the improvement loans obtainable through the Lands Improvement Company and the Agricultural Mortgage Corporation Ltd. Two of the advantages these facilities have over the other credit sources are that title deeds do not have to be deposited and that the rate of interest is static throughout the agreed period during which capital is being repaid (varying between ten and sixty years, according to the work involved). Capital may sometimes be found by the judicious sale of outlying portions of an estate (which, incidentally, may result in an increase in the value of the residue), and this particularly applies where the owner is faced with expensive repairs and improvements which are not likely to show a reasonable return in increased rents. Capital can also be raised on occasions by the discriminate felling of timber, provided there is a demand from local timber merchants.

Timber Buildings To meet the demand for buildings with a large clear span and maximum internal height, MR. C. V. TONGE explained that the Timber Development Association, Ltd. has developed the rigid frame building, in which the upright frame is theoretically continuous with the inclined roof member, so dispensing with the conventional tie-beam. In this type of construction essential rigidity at the joints is obtained by inserting steel plates between the double timbers of which the frame is constructed. Component parts for the frame are readily made by local contractors, and erection on prepared concrete foundations can be undertaken by unskilled labour. Complete sets of components ready for assembly can be obtained from manufacturers in various parts of the country to cater for buildings up to 33 feet span and heights of 8-16 feet. This wide range of dimensions provides a frame suitable for most farm requirements, and permits of any form of roof covering or walling.

The rigid frame is not necessarily the most economic form of timber construction, and if loss of headroom is not an important factor, the more usual triangulated trusses are often cheaper. Mr. Tonge said that the strength of a timber structure depends largely on the efficiency of its joints, and great progress had recently been made towards better jointing. For example, with the object of spreading the load over as much surface as possible, metal timber connectors are now inserted between the faces of the members to be jointed, and these bite into the wood when the bolt is threaded through and tightened. A joint of this nature is infinitely stronger than the old-fashioned type depending upon nails and screws.

Home-grown timber can be used with advantage in the construction of rough sheds for cattle or fodder. This simple form of building consists basically of pressure-impregnated poles sunk 4-5 feet in the ground and spaced at intervals of 10-15 feet. Poles are also used as principal roof members to support the smaller purlins carrying a light roof. Attention was drawn by the speaker to the necessity of rigidity at the base to avoid unequal settlement, and concrete foundations to the posts were recommended.

EXPERIMENTS ON THE USE OF GAS LIQUOR

J. WEBBER, B.Sc.

National Agricultural Advisory Service, Yorks and Lancs Province

Gas liquor is a virtually untapped by-product of the gas industry which, as N.A.A.S. experiments show, might be very useful as a nitrogenous fertilizer if it can be made available to the farmer cheaply.

MANY millions of gallons of gas liquor containing thousands of tons of nitrogen, are potentially available to augment the supplies of fertilizer nitrogen, yet they are largely wasted. That was the position, as seen by the Natural Resources Committee in 1952, which led to the planning and carrying out of the programme of N.A.A.S. field trials with gas liquor reported here. It is true that gas liquor is used extensively as a fertilizer in some parts of the country, especially the south of England, and it is estimated that in 1954-55, 5-6 million gallons were consumed in this way. Despite this apparently large consumption, huge quantities of liquor remain unused and present a considerable disposal problem to the various gas undertakings.

This by-product of the gas industry is produced when the crude gas from the retorts in which the coal is distilled is purified. The purification process is carried out in stages and the liquors produced vary in composition, depending on whether they come from the scrubbers only or contain material from other parts of the plant as well. During distillation, the nitrogen in the coal is largely released as ammonia, and this combines with other gases driven off at the same time; so that the gas liquor consists of a dilute solution of various ammonium compounds, together with phenols, tarry matter and other substances. Much of the tarry matter and also some other constituents are removed by the initial treatment of the gases; and scrubber liquor, which is likely to be more suitable for use on the land, is usually a fairly clear solution varying in colour from water white to brown and containing about 1-4 per cent nitrogen, usually as ammonium carbonate or ammonium chloride, with traces of other salts.

The experiments described here were carried out by Provincial Soil Chemists of the N.A.A.S. in various parts of the country, and with a few exceptions used either grass, kale or a cereal as the test crop. Their aim was to compare gas liquor with sulphate of ammonia or "Nitro-Chalk", when applied at equivalent rates, in order to assess to what extent gas liquor could be used as a substitute for standard nitrogenous fertilizer materials. After the first year (1953), when it was found that under some conditions serious scorching could occur, a comparison of gas liquor applied in January-February with similar dressings in March-April was made in the experiments on grass to see whether earlier application when the soil is cold and before growth has begun would reduce scorch.

Experiments on Grass In all these experiments gas liquor applied at two rates, 300 and 600 gallons per acre, was compared with sulphate of ammonia in equivalent amounts. The gas liquor was adjusted to a standard concentration ("10 oz" or 1.77 per cent nitrogen weight/volume), and the dressings chosen were equal to 2.3 and 4.6 cwt/acre sulphate of ammonia respectively. As the plots were small, the gas liquor was applied from a watering can, usually fitted with a special attachment of trailing pipes so that it was delivered at ground level, as in commercial practice. The grass was mown and weighed, usually as a hay crop, and in a few experiments second cuts were taken, either to measure residual effects or

the response to repeat dressings. In the three years 1953-55, over which the work was carried out, gas liquor applied in March-April was compared with sulphate of ammonia in twenty-eight different experiments and the following dry grass yields (in cwt/acre) obtained.

Year	No. of Centres	Treatment				
		Nil	Gas Liquor		Sulphate of Ammonia (equal to)	
			300 *gal/acre*	600 *gal/acre*	300 *gal/acre*	600 *gal/acre*
1953	9	38.4	39.4	37.2	45.4	47.9
1954	13	35.2	39.9	39.3	45.4	49.0
1955	6	23.1	29.7	27.8	33.9	35.4
All centres	28	33.6	37.5	36.1	43.0	45.7

Note. Results for first year of each experiment only.

The effect of spring dressings of gas liquor was very variable. At one centre in 1953 on a cocksfoot ley it gave higher yields than sulphate of ammonia, while at two centres in 1953 and one in 1954 scorch reduced the crop seriously on sites where sulphate of ammonia gave considerable yield increases. Taken over the whole series of twenty-eight experiments, the mean responses to gas liquor expressed as percentages of the responses to sulphate of ammonia were:

Rate *gal/acre*	Gas Liquor	Sulphate of Ammonia
300	42	100
600	21	100

In 1954 and 1955 gas liquor applied in January-February was compared with similar dressings applied in March-April at eighteen different centres, and the following dry grass yields (in cwt/acre) were obtained:

Year	No. of Centres	Treatments (gal/acre Gas Liquor)				
			Jan.-Feb.		Mar.-April	
		Nil	*300*	*600*	*300*	*600*
1954	13	35.2	41.2	46.4	39.9	39.3
1955	5	26.6	32.1	33.1	33.7	31.5
All centres	18	32.8	38.6	42.7	38.2	37.1

The comparison of the results obtained at the two dates of application is brought out more clearly if the responses to the gas liquor dressings are given as percentages of the response to equivalent dressings of sulphate of ammonia in the same trials:

Rate *gal/acre*	Gas Liquor		Sulphate of Ammonia
	Jan.-Feb.	Mar.-April	
300	54	50	100
600	73	32	100

The effect of winter dressings of gas liquor was less variable than that of spring dressings, and in no case was the yield of grass reduced, although usually the increases obtained were well below those from equivalent dressings of sulphate of ammonia.

The experiments indicate that while gas liquor is potentially valuable as a source of nitrogen for grass, it is essential to take precautions when using it if serious scorch is to be avoided. This is confirmed by experiments carried out in Scotland and reported by Tod and Simpson[1, 2]. In the trials reported

here, an attempt was made to imitate the methods of application used in practice and described by Marsden[3] and Lawrence[4] by using a watering can with a system of trailing pipes delivering the liquor at ground level, but this was only partly successful and in some trials bad scorching did occur. Application of the liquor early in the season before growth had started was more successful, but here there were undoubtedly losses due to evaporation and leaching.

It would appear, and Tod and Simpson's results confirm this, that even under the best conditions the efficiency of nitrogen applied as gas liquor is only about 70-75 per cent of that of nitrogen applied as sulphate of ammonia or "Nitro-Chalk". In practice, application should be made when there is little growth and in cold or damp conditions. Scorch is worse when grass is actively growing and in warm, sunny conditions, although it may vary with the type of sward and the amount of impurities in the liquor.

Experiments on Cereals Nine experiments were carried out on cereals, mainly winter wheat, in which gas liquor and sulphate of ammonia, both applied as top dressings, were compared. The gas liquor was applied from a watering can as for the grass experiments at various dates from March to May, and in all cases the plots were combined at harvest time and yield figures obtained. Gas liquor in most cases produced slight scorching of the crop, but recovery was usually rapid. The average yields in cwt/acre grain were as follows:

	Treatment			
No Nitrogen	Gas Liquor		Sulphate of Ammonia (equal to gas liquor)	
	200 *gal/acre*	400 *gal/acre*	200 *gal/acre*	400 *gal/acre*
24.1	26.9	27.8	28.1	29.5
Response as % of sulphate of ammonia	70	69	100	100

Here, too, the results indicate that gas liquor is about 70 per cent as efficient as sulphate of ammonia as a source of nitrogen. The scorch problem does not appear to be as serious as for grass, and in none of the experiments was there any lasting adverse effect on the crop because of it.

Experiments on Kale Kale is a crop for which heavy nitrogen dressings are required in order to obtain high yields, and fifteen experiments were carried out in which gas liquor at 400 and 800 gallons per acre was compared with sulphate of ammonia at the equivalent rates of 3.1 and 6.2 cwt/acre. On most of the experiments the fertilizers were applied a week or more before sowing to avoid possible harmful effects on germination, but in some it was put on as a top dressing later in the season.

At harvest time, the kale was cut by hand and weighed, and the yields obtained are given below in tons/acre:

Year	No. of Centres	Treatment				
		No Nitrogen	Gas Liquor		Sulphate of Ammonia (equal to)	
			400 *gal/acre*	800 *gal/acre*	400 *gal/acre*	800 *gal/acre*
1953	7	20.0	23.6	24.8	24.0	24.3
1954	4	11.7	15.0	15.3	15.0	16.5
1955	4	14.8	18.8	22.0	20.1	22.1
All centres	15	16.4	20.0	21.5	20.6	21.6

EXPERIMENTS ON THE USE OF GAS LIQUOR

In these experiments gas liquor and sulphate of ammonia gave almost identical results. Scorch did not occur, since the application was made either before sowing or between the rows of the crop, and the loss of nitrogen due to evaporation must also have been small.

Conclusions Large quantities of gas liquor, perhaps equivalent to 50,000 tons of nitrogen, are produced each year by the British gas industry, and at present only a small proportion of this is used in agriculture. The conversion of the dilute gas liquor into fertilizers such as sulphate of ammonia is not an economic proposition, except in the case of some very large gas-works. Practice in the south of England and elsewhere shows that gas liquor without further treatment can be used successfully as a fertilizer, provided care is taken to avoid the inclusion in it of tarry matter and other harmful impurities.

The results of twenty-eight experiments on grass are summarized and the results obtained show that sulphate of ammonia was generally superior to gas liquor as a source of nitrogen. The effectiveness of gas liquor was less with dressings made in March and April, after growth had begun, than where dressings were applied during the winter months. Care was necessary at all times to prevent scorching of the grass, and this could be reduced by applying the liquor through trailing pipes 6 inches apart or by choosing sites with little or no growth and making the application in cool or wet weather.

For grass or cereals, the liquor was usually from two-thirds to three-quarters as effective as sulphate of ammonia, but given unfavourable conditions could be considerably worse than this. Experiments were also carried out on kale and here the liquor gave satisfactory results—very similar to those from sulphate of ammonia, whether applied a week or two before sowing or later in the season as a top dressing. Provided the cost to the farmer is not too great, gas liquor is a useful source of fertilizer nitrogen, but care is required in its use to keep the possible effects of scorch to a minimum.

References

1. Ammonia Liquor as a Nitrogenous Fertilizer. H. Tod and K. Simpson. *Gas J.* 1955, **281**, 857, and *Edinburgh E. of Scot. Coll. Agric. Misc. Pub.* 146.
2. Ammonia Liquor as a Nitrogenous Fertilizer. H. Tod and K. Simpson. *J. Sci. Food Agric.* 1956, **7**, 511.
3. The Use of Ammoniacal Liquor as a Fertilizer. A. Marsden. *Gas World* Jan. 1954.
4. Ammonia Liquor as Agricultural Fertilizer 1955. H. M. Lawrence. *Inst. Gas* Engineers, 22 p.

SELECTIVE WEED CONTROL WITH MCPB

PROFESSOR R. L. WAIN, PH.D., D.SC., F.R.I.C.
Wye College, University of London

MCPB is one of the most important of the "hormone" weed-killers, but it must be chosen in relation to the job which it is capable of doing.

THE introduction of the so-called hormone weed-killers into British agriculture at the end of the last war was an event of tremendous importance which has led, among other things, to much greater flexibility in the cropping programme, a saving of labour and higher yields. The greatest benefits have been in cereal crops, where it is estimated that spraying has increased yields by an average of some 10 per cent. Hormone weed-killers such as 2,4-D and MCPA have many advantages from the farmers' point of view: they are destructive to weeds at very low concentrations, they dissolve freely in water, they are non-poisonous and not objectionable to use; also, they are not expensive. Furthermore, they possess a high degree of selectivity, leaving cereals and grasses practically unharmed when applied at the right time and the right dosage rates. No wonder then that, with all these advantages, their use is widespread. It was estimated several years ago that these chemicals were sprayed on to 100 million acres of farm land each year; today the figure must be higher than this.

It should be remembered that the phenoxy acids MCPA and 2,4-D, although often referred to as hormones, are not true plant hormones because they do not occur naturally within the plant; they are synthetic chemicals, made in the chemical factory. The interesting thing about them, however, is that they are capable of producing growth responses in plants which are very similar to those induced by the plant growth hormone itself. Many of these responses, such as bending of leaves and stem, the initiation of roots and the setting of certain fruits in absence of pollination, can be brought about by very low concentrations of these phenoxy acids—as little as a few parts in a million of water is often sufficient. When much higher concentrations than this—say, 1,000 parts per million—are sprayed on to plants, twisting and distortion may occur with splitting of the stem, production of aerial roots and other drastic effects; indeed, the physiological disturbance caused by such treatment may be so violent as to destroy the plant completely.

Some species of plants are very susceptible indeed to the action of these chemicals: charlock, for instance, can be killed by a few ounces of 2,4-D or MCPA per acre. Cereals and grasses, on the other hand, can be destroyed only by very high doses; so that by choosing the right quantities and spraying at the right time, it is possible to destroy many weeds in growing corn without damage to the crop.

Now in spite of the outstanding benefits which these chemicals have provided for the farmer, there are several requirements which they do not meet. Firstly, there are a number of important weeds, such as mayweed, field pansy, knotgrass, wild oat and blackgrass, which are either only poorly controlled or not controlled at all by these substances. Fortunately, other chemicals such as DNOC (dinitro-ortho-cresol) and TCA (trichloroacetic acid) are available to attack some of these weeds, and there is no doubt that research will provide many more new chemicals as time goes on.

Apart from the fact that the hormone weed-killers fail to control a number

of important weeds, there is a risk of damaging cereal crops if the spray application is made at too early a stage of growth. Thus it is well known that treatments made earlier than the six-leaf stage often lead to severe ear distortion and loss of yield, especially in wheat and barley. Another limitation of 2,4-D and MCPA is that they cannot be used on undersown cereals without risk of damage to the clover. Red clovers are rather more resistant than white clovers, and 2,4-D is more damaging to red clover than is MCPA. Although the chemicals can often be used with some degree of safety if spraying is carried out when there is a good cover of weeds to shield the clovers, danger always exists when these chemicals are applied to undersown corn crops.

Conversion of Chemical to Hormone Problems such as these have to some extent been overcome by the discovery of a new group of selective weed-killers—the phenoxybutyric acids, of which MCPB (methylchlorophenoxybutyric acid) and 2,4-DB (2,4-dichlorophenoxybutyric acid) are the most important. The unique mode of action of these chemicals was first announced by the writer in September 1954, at the Jubilee Meeting of the Association of Applied Biologists in London.

It is of interest to recall that the work, as originally planned, was not related to weed control at all but was an academic investigation designed to show whether plants were able to break down fats in their tissues in the same way as was known to occur in the animal body. To determine whether this kind of breakdown did occur in plants, a number of acids were specially prepared which were related chemically to hormone herbicides such as MCPA. The chemical make-up of some of these new substances (MCPB for example) was such that if the plant could break them down by a process similar to that occurring in animals, the substances would be converted within the tissues of the plant to the active growth substance—MCPA. In all our early experiments this breakdown did in fact occur—as was shown by the treated plants or pieces of plant tissue used in laboratory experiments developing typical growth responses. These results then, together with those of other experiments, gave strong support to the idea that some of the basic chemical processes going on within plants and animals are the same. But this conclusion, although of great interest to the biochemist, had in itself no particular significance in the field of selective weed control.

The finding which was to make the work of great practical importance came later, and quite unexpectedly, when some similar chemicals were being tested for their capacity to produce growth responses in wheat and in pea stem segments. The chemicals induced active responses in the wheat, showing that they were being converted to the hormone in the wheat tissue: but with the pea segments, no growth response was obtained. This surprising result could only mean that the harmless chemical applied was being converted to a potent hormone within the tissues of one species of plant and not in another. Now came an important question: could this finding have a bearing on selective weed control? Was it possible that a harmless chemical might be converted to a herbicide in one plant and so destroy it, whereas another plant, similarly treated, would remain unharmed?

A wide range of chemicals were prepared which, acting in this way, might be useful commercially for controlling weeds in crops. These chemicals were applied to some forty species of weeds and crop plants growing in pots in the glasshouse, and a number of small-scale field trials were also undertaken. The results in many cases were spectacular, and the two compounds which the writer named MCPB and 2,4-DB proved extremely promising for

selective weed control. Applied at rates of less than 2 lb per acre, these chemicals will control a number of troublesome weeds, such as annual nettle, fat-hen, knotgrass, fumitory and creeping thistle, yet a number of important crop plants, such as cereals, clover, peas and celery, remain practically undamaged by this treatment. Of course, not all weeds are destroyed. Some in fact—for example, mayweed, chickweed and groundsel—are very resistant. Again, many crop plants themselves, having the capacity to change the chemical into the herbicide, are readily destroyed by these substances.

Since this new approach to selective weed control was first put forward, experiments with these materials have been performed on a wide scale not only in England but all over the world. Hundreds of trials have been carried out in this country, and prominent in these investigations have been Mr. K. Carpenter and his team at Ongar and Professor G. E. Blackman and his colleagues at Oxford, though many other official and commercial organizations, as well as individual workers, have also been active in this field. Furthermore, MCPB has now been made available to farmers as commercial preparations.

Butyrics in Use From the results of all the trials carried out to date and the many other observations made on the performance of these new weed-killers, it is now possible to make an assessment of their value for controlling weeds in crops. So far, much more is known on the performance of MCPB, but in so far as 2,4-DB has certain special properties, it will be covered in this account.

Now the first point to be emphasized in all discussions on selective weed control is that the weed-killer should be carefully chosen in relation to the job to be done. These new "butyrics" are no exception to this. They can only be used with a limited number of crops and they do not kill all kinds of weeds. This season there will be a number of proprietary brands of MCPB on the market and all makers will give full instructions regarding susceptible weeds and resistant crops and how the product should be used. These must be closely followed. If the dominant weeds are not susceptible to MCPB or 2,4-DB, then success cannot be expected. On the other hand, if susceptible weeds are infesting a crop which is tolerant to MCPB, then one may go ahead, but it is nevertheless important to appreciate two points. First, it must be remembered that the chemical can kill the weed only if it gets into its tissues, for it is there that it is converted into the herbicide. This means that most of the spray should go on to the plants; any which goes on bare ground is to all intents and purposes lost—as in any which runs off the plant during spraying. For these reasons, a low volume spray applied when there is a reasonable ground cover of weeds should give the best results. This does not imply, however, that spraying should be delayed until the weeds have grown out of the seedling stage—a stage when they are usually most susceptible to the herbicide.

The second important point to remember is that these chemicals are not themselves herbicides—they are *converted* into herbicides by the weed—which in this way brings about its own destruction. Now this change into the active chemical takes time and, moreover, the speed of action may vary with temperature and stage of growth. For this reason, immediate or quick results should not be expected after spraying with MCPB. Many farmers last season, well accustomed to the rapid action of MCPA, were disappointed when severe effects were not showing on their weeds a few days after treatment—though usually they got good control later. Charlock, however, was not adequately controlled at all stages of growth, though in some cases where poor control was reported the weed in question was not charlock at

all but the yellow-flowered variety of wild radish, which is very resistant to MCPB. Young charlock plants are quite susceptible to MCPB, but it is known that they become more resistant with age and that once they have developed their flowering shoot, a satisfactory control of this weed cannot always be expected. To a large extent, however, this difficulty can be overcome by applying the spray early. Fortunately, it is quite safe to do this with cereals when MCPB is used. Indeed, one of the important features of this substance discovered last season is that MCPB, even at rates higher than those required to obtain weed control, can be applied with complete safety to cereals at the very early stages of growth. As already mentioned, these young cereal plants are susceptible to treatment with MCPA and 2,4-D, and it can lead to serious ear distortion in the mature plant. To be able to spray cereals when both weeds and crop are young, not only extends the spraying season and removes weed competition from the start, but it offers a large number of other advantages.

Perhaps the greatest value of MCPB, however, lies in the fact that, unlike MCPA and 2,4-D, it is not harmful to clover when applied at strengths necessary to kill weeds. With MCPB, therefore, it is now possible for the first time to control certain weeds with safety in cereals undersown with clover and in grassland where clover is present. The results of trials carried out so far in Europe and America all emphasize this clover-sparing action, which is such a valuable feature of MCPB from the agricultural viewpoint.

In Vegetable Crops Another development from last season's work is the finding that MCPB can be used to control weeds in certain varieties of peas. These include Harrison's Glory, Onward, Alaska, Lincoln and a number of others. Excellent results have been obtained both here and in America in removing creeping thistle from the pea crop, an operation which hitherto could never be carried out with chemicals. In spraying peas with MCPB, the best results have been obtained when the crop is 3-6 inches high and showing two to eight expanded leaves. Although MCPB applied to resistant varieties of peas causes only slight depression of yield, some growth distortion and check to growth may be expected after the spray application. But this is generally a temporary effect. The following weeds growing in the pea crop can usually be eliminated by MCPB applied at the rate of 3 lb per acre: annual nettle, black mustard, charlock, corn buttercup, creeping thistle, fat-hen, fumitory, hemp nettle, pennycress, poppy and treacle mustard.

On vegetable crops, our early demonstrations that MCPB may be used to control certain weeds in celery have been confirmed. Thus a striking eradication of annual nettle growing with this crop can be achieved by one application of MCPB at 2 lb per acre. With carrots and parsnips, however, further work is required before any recommendations can be made. Roberts at the National Vegetable Research Station found in his experiments that, although the stand and yield of these crops were not affected, treatment with MCPB at 1 lb per acre could result in a certain amount of abnormal root development.

Of the other selective weed-killers which have arisen from our fundamental investigations at Wye, 2,4-DB is undoubtedly the most important. Like MCPB, it can be used safely on cereals and on clover, though it is very damaging to peas. Lucerne, however, is much less susceptible to 2,4-DB than to MCPB, and the indications are that the 2,4- compound will prove to be a useful weed-killer in this crop. Although much has been found about the performance of MCPB and 2,4-DB since their discovery in 1954, there is a great deal more research to be done, both in the laboratory and in the field,

if these chemicals are to make their maximum contribution to agricultural production.

The results of a large number of field trials with these new butyric herbicides were presented recently at the Third British Weed Control Conference. These research reports will be published in the Proceedings of the Conference, which will also include an excellent survey by J. D. Fryer and S. A. Evans on "The Place of MCPB and 2,4-DB in British Agriculture". Those who wish to know more of the present position regarding these new weed-killers will await this publication with interest.

CONCENTRATE SPRAYING

M. H. MOORE, M.SC., PH.D., DIP.HORT.

East Malling Research Station, Maidstone

Concentrate spraying is reviewed in its relation to low volume spraying as a whole. The merits of the use of reduced volumes of spray in practice are discussed on a broad basis against the background of accumulated field experience and the findings of research.

THE new technique of controlling pests and diseases by the use of much smaller volumes of spray than had become normal to hydraulic spraying has been responsible for fresh problems in terminology. The term that gained most currency was "low volume spraying", though some may object on the grounds that a volume is large or small and not, like pressure, high or low. Nevertheless, "low volume spraying" has a euphony that "small volume spraying" lacks, and, correct or not, the term has probably come to stay. An alternative that has been used, however, especially in Canada and the U.S.A., is "concentrate spraying"—a distinction without much real difference in this case, for in practice a reduction in volume is almost invariably accompanied by an increase, usually proportionate, in concentration. Both terms are acceptable as generalizations; but neither is, nor can be, definitive. Close definition is perhaps best achieved by stating the actual volumes and concentrations under consideration.

In recent years, however, the term "concentrate spraying" has assumed a more specific connotation in this country. The tendency is to reserve it for really low volumes of spray at really high concentration; for example, where the volume is only about one-tenth or less, and the concentration is ten or more times what would be used in spraying the crop by normal hydraulic methods. This tendency has resulted from experimental findings that liquid chemical preparations for pest and disease control (for example, lime sulphur) can, with little or no dilution, safely and effectively be applied to growing crops.

Advantages and Disadvantages It is, however, a mistaken conception of low volume or of the more specific "concentrate spraying" to suppose that it will provide greatly improved control of pests and diseases, for this was already very good from efficient high volume spraying. The advantages of the new technique lie in other directions, and are obvious enough to need little comment. They are chiefly the saving of spraying costs by greatly reducing the problems associated with supplying and handling large quantities of water; actual spraying time is increased because much of the time spent in travelling to and from the water

supply, and in filling large tanks, is eliminated. Machines can be smaller and more manoeuvrable, and any adverse effects on the soil in the alleys between the crop are therefore reduced. It is not always fully appreciated that 100 gallons of water weigh nearly half a ton, which is dead weight, extra to that necessarily involved in the spray machinery. All these advantages, of course, become greater as the volume of water used as a diluent is reduced towards zero.

Probably the chief disadvantage of low volume spraying is the tendency for the small droplets of a mist-blown spray to drift farther than the larger droplets that comprise a hydraulic spray. This is particularly true in fruit growing. For this reason, the hazards to man from very poisonous sprays could be extended over a wide area, and such sprays are therefore best avoided for use as mist-blown concentrates.

Difficulties of Experimentation For the same reason it is much more difficult for the experimenter to design a satisfactory layout for the usual kind of spray trial; plots need to be large so that a sufficiently deep perimeter around each can be allotted as a drift barrier, but where several treatments are to be compared and adequate replication is allowed for, the area of land and trees required can soon become unmanageable. There is much to be said in this case for carrying out basic experiments on small trees with small-scale spray machinery, for at least the trees can, if necessary, be screened from spray drift and treated individually, when a satisfactory degree of replication is feasible. Treatments that show no promise or that cause spray damage under these conditions are unlikely to be successful on a larger scale, and thus only the most promising need be considered for extended testing.

This method is, however, the well-known research approach, and is apt to be considered too slow as a prelude to the development of a new technique that promises spectacular advances. In practice, it is quicker to test a method of spraying on an acre or so of crops to see whether or not it works; if it does, all well and good; if it does not, a few modifications may effect an improvement next time. This approach must necessarily yield practical results, some desirable and some not, more quickly than a more rational progression from one series of established facts to the next, and as a means of expeditiously meeting some of the growers' demands, it undoubtedly plays an important part, supplemented, but not supplanted, by research.

Present Status of the New Technique Our present knowledge of the extent to which low volume and concentrate spraying can take over the role of hydraulic spraying has been acquired from both of these contrasting approaches, though for the above reason heavily weighted by the large-scale field trial with little or no plot replication, and therefore no adequate means of testing the likely reproducibility of the results. The more intensive trial suffers from a similar limitation but for a different reason—results obtained on small trees with miniature machines may not be as easily reproduced by necessarily more cavalier methods on larger trees—but it can at least offer valid comparison at its own level.

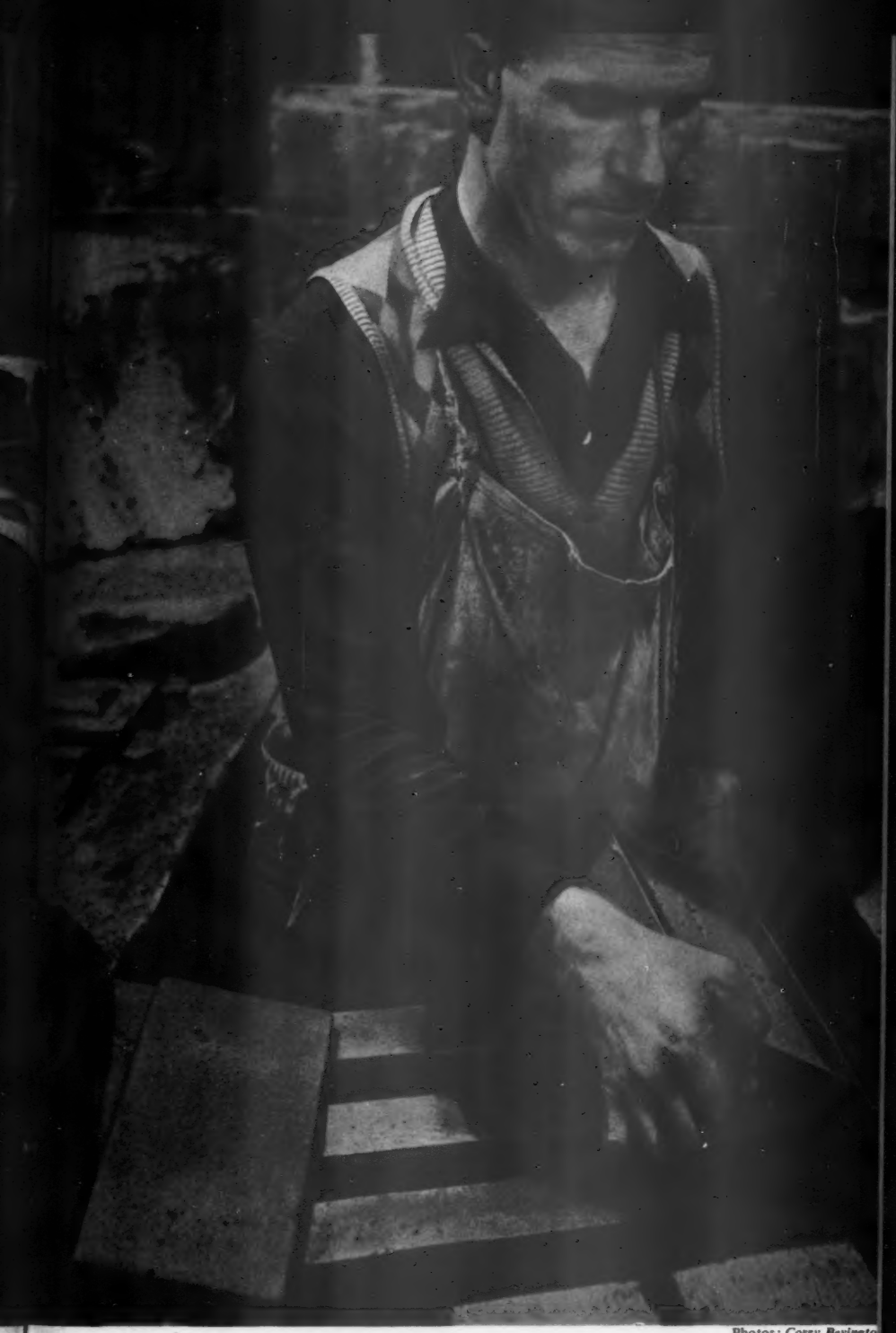
With due regard for these difficulties, however, enough evidence has now been accumulated from various parts of the world to indicate that low volume spraying has probably come to stay. This technique has developed suddenly, as a revolt from the rather absurd lengths to which post-war developments in hydraulic spraying had been leading. It follows that existing chemical preparations are being adapted to uses for which they were not

Experimental air-blast machine made by the National Institute for Agricultural Engineering, for trials of concentrate sprays in the plantation.

Photos: *East Malling Research Station*

Flower trusses of apple showing (*left*) adequate and safe deposit, and (*right*) excessive and damaging deposit of undiluted lime sulphur.

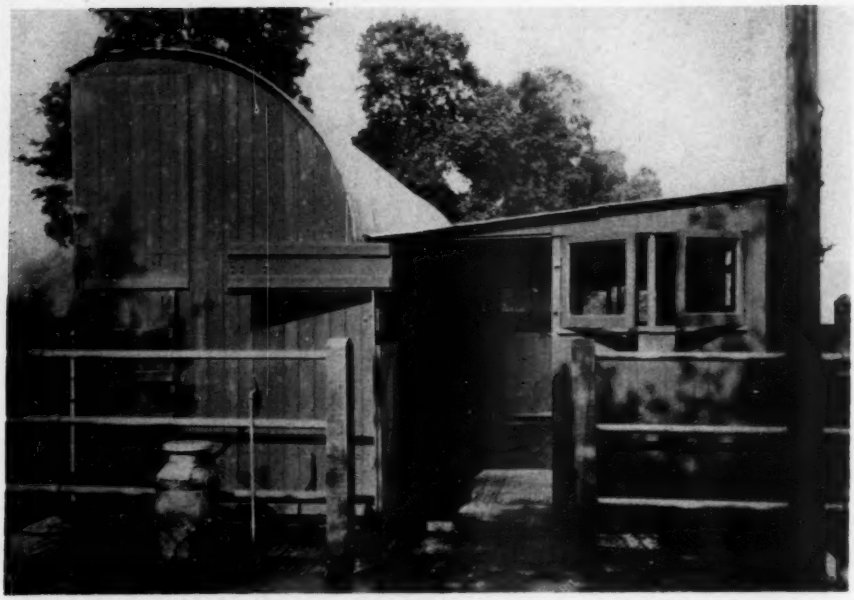
A Small Brickyard (Article on pp. 585-7). A clot or "clod" of clay is taken from the pile and or blade. The base of the mould can be seen on the brickmaker's table; the raised creates



Photos: *Corry Bevington*

m tile and thrown into the mould, surplus clay being removed with a wooden " strike "
ed creates the recess or " frog " in the brick.

Bail Milking on a Fixed Site (Article on pp. 588-91)



A milking bail on a concreted site, with a built-on extension. Note also the stout fencing and the water tap.

Full churns of milk being taken from the bail to the milk room.

designed, and that machinery is being rather quickly developed before the requirements demanded of it are well enough defined on a factual basis. Improvements along both lines are inevitable with further experiment and experience, and it is the more noteworthy in the circumstances that such good progress has already been made. Many thousands of acres of fruit have now been satisfactorily sprayed at volumes of some 25-50 gallons an acre, where hitherto about ten times these quantities per acre might have been used by the hydraulic method. There is as yet less plantation experience in England of the lower volumes that comprise the higher concentrations of spray, but more machines designed to this end are now coming on the market, and the number of satisfied users is steadily increasing.

From the intensive research approach to the problem, conducted mainly on small trees, one fact has consistently emerged that can be used as a reliable guide in general spraying practice. It is that successful control of the pests and diseases under experimental observation depended broadly on the dosage of the chemical; that is, the quantity of undiluted concentrate per acre, irrespective of the volume in which it was applied, provided, of course, that the method of application yielded satisfactory coverage of the host plant. To take for example lime sulphur used against Apple Scab, a dosage of about 3 gallons an acre was found to be optimum for small trees not more than 7 feet high when sprayed with droplets of some 30-40 microns average diameter in compressed air delivered through a paint gun. It made no substantial difference to the control of this disease whether the lime sulphur was applied undiluted at 3 gallons an acre or diluted $\times 2$, $\times 4$, or $\times 8$ with water and applied at 6, 12, or 24 gallons an acre. Indeed, a similar dosage diluted to normal and applied hydraulically gave similar control. The same general conclusion held good for Apple Mildew, and recent entomological work has confirmed that it applies also to Apple Sawfly control.

It was further concluded from the work with lime sulphur that spray damage was less a matter of concentration of material than of its concentration in relation to its volume. Thus as the volume of spray increased while the dosage remained constant, the risk of spray damage increased, especially when the volume was sufficient to cause the droplets to coalesce into pools or films on being deposited. Maximum concentrations proved safe, provided the droplets remained discrete; safer, in fact, than the normal dilute hydraulic sprays.

Volumes and Droplet Sizes The question of droplet size is an important one, especially at the lowest volumes. It must be emphasized that the volume of a droplet increases eightfold as its diameter is doubled, and thus droplets of, say, 100 microns diameter will be only one-eighth as numerous as those of 50 microns from the same total volume of spray. Because of this, machines designed to work at the lowest volumes are most likely to achieve greatest efficiency in coverage only if they produce mists composed of small droplets. Machines that produce rather larger droplets require larger volumes of spray to deposit the same number of droplets on the same area, for the same reason. Here, then, is an essential distinction between medium volume and really low volume spraying; or, as it was defined earlier, low volume and concentrate spraying.

Limitations of Low Volume and Concentrate Spraying The limitations that attach to the adoption of either method can now be made clearer. From what has been said about dosage, it is obvious that, to be effective, the smallest volumes of spray must contain high concentrations of the chemical. They must also be

broken up into very small droplets. But though the smallest droplets give the best coverage because they can be most closely packed together on the host, the smaller they are the greater the force needed to impact them, and therefore the more likely they are to go astray *en route*. There is, in fact, with large-scale machines, a limit of some 40-50 microns diameter for droplets in the plantation, and below this it would be impracticable to go, as well as probably too costly in machinery to produce them. In warm climates, in which the droplets would rapidly evaporate before impaction, it might be necessary to increase this limit substantially.

Investigations on a plantation scale with special experimental machinery have confirmed the findings of intensive investigations in demonstrating the effectiveness and safety of lime sulphur concentrate for the control of Apple Scab, though large trees, especially if they are crowded, are difficult subjects alike for low volume as well as high volume treatment.

Where rather larger droplets and therefore larger volumes are adopted, the limitation applicable to lime sulphur, and probably also to some other chemicals, is the increased risk of spray damage where droplets containing fairly high concentrations of chemical do not remain discrete after impaction. The more quickly the droplets dry, the more likely is the spray to prove non-phytotoxic. Whatever the explanation may be, it is evident that small, discrete droplets, by reason of their greater surface/volume ratio, will dry more rapidly than pools or films of spray.

Conclusions As the chief advantages to be gained from spraying at reduced volumes are greater convenience, greater speed, and saving of costs, it seems obvious that the aim should be to reduce volumes as much as is feasible and economic. In spite of the rapid progress that has already been made in solving some of the problems of the new technique, it is doubtful whether we are yet in a position to say confidently which, if indeed any one, low volume level is likely to prove generally most desirable on grounds of efficiency. Much will depend on the conditions on the farm, the suitability of the crops for a particular type of treatment, the efficiency of the machine, and obviously on the economics of the choice. It seems clear from experiment and experience that the dosage per acre of the chemical is the best single guide to effectiveness of treatment, provided spraying conditions permit of efficient coverage. On this basis the concentration of spray necessary at any selected volume level can readily be calculated from what is known to give good control at high volume. This basis of choice will probably not prove infallible in all circumstances, but at least it makes as reasonable a starting point for practical guidance as any other, though it should not be overlooked that medium volumes at medium concentrations of certain chemicals may not prove as harmless to the host plant as lower volumes at higher concentrations.

It is manifestly impossible to compare all machines and all chemical sprays at all volumes, concentrations, and droplet sizes, so that much of our information must be built up from an accumulation of experience under differing conditions, harnessed to the results of experiments designed to reveal the underlying principles. When viewed on the basis of dosage, methods of approach to low volume spraying that at one time may have appeared to be unrelated, if not even conflicting, are seen as but different points along a continuous sequence of volume/concentration levels. The choice of any one of these in practice will depend on the factors mentioned above, as, indeed, any choice is governed in matters other than spraying. Efficient and economic versatility in the performance of individual machines can offer the grower some relief from the need to make his choice within narrow limits.

SPRAY DRIFT

J. R. MACDONALD
Little Clacton, Essex

Selective weed-killers have become a valuable asset to good management, but the risk from spray drift and "blow-off" is causing concern.

IT is often claimed by the cynics that when a scientist succeeds in discovering something for the good of mankind there is always someone at his elbow ready to turn that discovery to our disadvantage. But what is perhaps much nearer the truth is that during the development of the initial idea there frequently emerge a number of undesirable secondary effects. We have one example of this in the introduction of what, on the face of it, is a valuable asset to good management—the selective weed-killer. It can do a most effective job, but what of its side effects when accidentally it drifts on to the susceptible crops on the other side of the fence?

Let us look at the following record of damage caused by drift or "blow-off" of selective weed-killers in one particular county:

Year	No. of Cases	Estimated Cost of Damage
		£
1947	—	—
1952	3	1,000
1956	27	12,000

This is not, thank goodness, typical of what is happening all over the British Isles, but it is typical of those counties where the farming pattern is mixed, and where cereal, vegetable, fruit, glasshouse and flower crops are grown cheek by jowl. Startling as such figures are, they do not give the whole picture, since only the cases reported to the local N.A.A.S. officers or N.F.U. offices get included in records such as the one quoted above. Undoubtedly, a few recognized cases are never reported, but are settled "over the hedge"; moreover, there are good grounds for believing that in many instances lack of vigour in a crop or partial failure has been attributed to disease or cultural neglect, when it should have been laid at the door of the selective weed-killer. It is only fair to say here that it is also possible to blame the selective weed-killer unjustifiably, but so far there is nothing to indicate that this happens very often.

The foregoing figures are enough to show that the agricultural industry has created for itself a serious problem. If the undoubted benefits of chemical weed control are to be fully enjoyed, then urgent action is needed by all concerned to prevent damage being done to valuable crops by efforts to improve others and to reduce the distress, both financial and emotional, caused to the unfortunate victims.

At this point it is as well to emphasize that the problem is one for the industry as a whole, and not for just one section. Susceptible crops are likely to be grown by all of us, from the allotment-holder to the limited company farming 10,000 acres. The fact that the greater part of the crops most likely to suffer are grown by horticulturists is by the way; it has no bearing on the main issue. It is not a question of one group within the industry causing injury to another group. Everybody, large and small, intensive or extensive, cereal grower or vegetable grower, is liable to control his weeds with growth-regulating chemicals, and therefore to do his neighbour an injury. No, we are all in this together.

The problem can be split into two main divisions, which may conveniently be called prevention and cure. The first needs no explanation, but it might be as well to say that by "cure" is meant the treatment and compensation of the victim. Yet, although prevention is, in the long run, far more important than cure, it is more difficult to achieve, and, of course, is of little immediate interest to this year's victims. It might therefore be better to reverse the order and consider cure first.

What is the Remedy? For two or three years now, certain sections of the industry have been pressing for compulsory insurance to cover third-party risks by all people using sprays. Their opponents have invariably answered: "Why? You have a remedy at common law!" It is true that, in theory, the victim has such a remedy, but to be successful he must first prove to the satisfaction of the court that the damage was caused by a chemical weed-killer, and not by disease, weather or neglect. This may be, and usually is, difficult, because with our present knowledge there is no absolute means of diagnosis, and the evidence that the victim can advance will, unless he is very lucky, be mostly negative. Even if this hurdle is cleared, there is worse to come—the plaintiff must next prove who among his neighbours was responsible for the damage. It needs little imagination to realize how nearly impossible this may be. In a season like 1956, when growth was slow in May and June, it may be several weeks before the effects of spray drift become apparent, and before the person whose crops have suffered realizes the need to collect evidence. If, as may well be, he then finds that all his neighbours sprayed their crops, and all within a week or ten days, then his task is hopeless, and he may as well give up and resign himself to writing-off his losses. In effect, therefore, the common law has broken down, and the claimant is without remedy. This is not an acceptable state of affairs.

There is little that the potential victim can do about this himself. True, for the moment, he can insure at a premium of between 1 and 2 per cent of the value of the crop; but as the demand for this type of insurance is only likely to come from the high risk areas, it is doubtful for how long it will be available at this price.

How can we ensure a fair settlement of claims for damage? What is wanted by the person suffering the damage is, to my mind, clear enough—namely:

1. A positive means of diagnosis of spray damage. This means research, and official research at that. Some growers' organizations have offered to contribute towards the cost, but the funds available are not enough to make an appreciable impact.
2. A fund from which compensation can be paid on proof that chemical weed-killers (no matter from what source) are the cause of damage. All manufacturers, users, and potential victims might contribute to this fund, which should be viewed as part of the proper price to pay for a major advance in crop husbandry. Legislation to bring this fund into being would appear to be unavoidable.

How Can We Prevent Damage? So much for the line of action when damage occurs. The problem of prevention is very largely a question of educating users in the safest techniques, and how they and their neighbours can co-operate to reduce the risks. But all this is of little use if the knowledge is not there to impart, and anyone who has studied this question will have realized very quickly how woefully short of knowledge we are about many aspects of the use of selective weed-

killers. Filling these gaps is a job for the scientist and the technician, but it may be useful to outline the major gaps to be filled. In my opinion these are:

1. *Range*—namely, the distances at which dangerous concentrations may be found as a result of spray drift and "blow-off".
2. *Persistence.* How long after application can "blow-off" occur?
3. *Application technique.* The effect of high and low volume application, and of nozzle design on liability to drift.
4. *Protective devices.* Are boom shields and drag-sheets effective, and to what extent? What is the best height for the boom?
5. *Formulation.* Are some weed-killers more likely to lead to trouble, and, if so, do the advantages they possess justify the added risks?

To emphasize the need for this research, it is necessary only to look at what were considered, until very recently, "safe" conditions for spraying. A year or two ago one would have been told that provided there were no susceptible crops nearer than 200-300 yards down wind and the wind was light, there should be no risk. Today we know from bitter experience that half a mile is not a safe distance (the Americans speak of four miles!), that apparently still air is no protection, and that adjacent crops may escape while a remote crop may suffer. Many of us also believe that "blow-off" can occur days after application.

No doubt there is always likely to be an inherent risk in the use of these weed-killers, but there is equally little doubt that present conditions in the danger areas are intolerable. It is therefore of the greatest urgency that we should get this formidable weapon under control without delay.

THE SMALL BRICKYARD

DAVID THOMAS
Rural Industries Bureau

Even in the present era of factory production, locally-made, hand-moulded bricks are claiming marked attention for their perfection of colour and durability.

THE local characteristics by which an Englishman can almost unconsciously tell his whereabouts in the country are quickly dwindling. Those which were man-made, like signposts, farm vehicles or railway liveries, have been scrambled or standardized away. Building materials, which once gave positive evidence of locality, no longer identify particular counties or regions, and it would be foolish to expect local variations in prefabricated Dutch barns or implement sheds.

On the other hand, the small country brickmaker—a man who has done so much to preserve the link between buildings and local geology, has by no means been displaced by the flood of synthetic blocks and panels leaving the factories. He can draw comfort from the fact that demand for his product has been firm since the Babylonian era, though it lapsed to some extent in England between the Roman evacuation and the thirteenth century, and was subject between 1784 and 1850 to an unwise tax.

Unlike many manual processes, that in which a "clot" or clod of "pugged" or kneaded clay is sanded and thrown with precision into a wooden mould

cannot be superseded by a machine operation without loss in the finished brick of weathering quality, colour and texture. The folds caused by the impact of clay in the mould and the fusion of the sand on its face during the burning, produce a texture and bloom as characteristically English as the green turf and white posts and rails of a racecourse, or the authoritative contours of a policeman's helmet. Because of this quality, which time and weather only can improve, English hand-moulded bricks still command about one-sixth of the enormous market available to bricks in general, and they are sought after not only by house builders but by the architects of cathedrals and even power-stations.

But in the processes which come before and after this stage, disregard of modern techniques can bring little advantage and may endanger the future prospects of a yard. Once the clay has been dug and exposed to the winter air—and weathering is essential if bricks are to dry soundly—machinery can do much to keep the small brickyard in businesslike condition. The tempering or pugging of the clay by horse or spade labour is extravagant and archaic, and oil or electric power has almost—not quite—ousted it.*

The purpose of this operation, however, remains the same. Though the clay has been exposed to frost and occasionally turned over with the spade, it is far from being sufficiently even in consistency for moulding and burning. The pug-mill is very like an enormous churn fitted with rotating blades or paddles. After these have broken up the clay, it passes into a drum where stones and pebbles are separated from it. Then it is usually squeezed through small holes to form what looks like spaghetti or worm casts, and delivered through a primitive extruding device as a continuous bar about a foot square in section. From this, a wire "bow" is used to cut off clots of sufficient bulk just to overfill the brickmaker's mould.

Drying and Burning It is still more important to the small brickmaker that in the process of drying his freshly-moulded bricks, he should make the utmost use of modern methods. The old-fashioned seasonal yards were content with drying in "hacks" or stacks, or at best in an open-sided shed where draughts could cause unequal drying and hence malformation after burning. This method is far from extinct, but for several years the clay industries' staff of the Rural Industries Bureau have been busy advising small brickmakers on the installation of steam and hot air drying methods, and many of them have been brought up to date in this respect. Moreover, it has been estimated that in yards without mechanical driers one of the eight man-hours needed to produce a thousand bricks is used up in transport to and from the drier. No country brickmaker can afford to overlook figures like these.

The last stage in the making of a brick is the burning. The processes involved here are chemical as well as mechanical, but though they are so much more complex than the other stages of the work, it is only lately that small yards have begun to apply scientific principles to them.

Burning not only determines the strength and weathering quality of brick; its colour can be affected considerably by the admission of air to the kiln in the final stages. It is during burning that, between definite limits of temperature, bricks become vitrified. Moreover, defects in preparation and drying often do not declare themselves until burning takes place, when the brick may become cracked or deformed through unequal drying, or even later be burst by the presence of quicklime in the clay.

* A horse-driven pug-mill was still in use in the summer of 1953 near Beccles in Suffolk.

Continuous Kilns Before temperature limits can be controlled, a closed kiln is needed. With the traditional method of burning in " clamps " or stacks in the open, bricks must often be discarded because of unequal or excessive burning, but even between types of kiln there are great disparities in cost and efficiency. " Intermittent " kilns are those which must be allowed to cool after each burning so that bricks may be removed. They are thus far more wasteful of heat and work than " continuous " kilns, where the heat, instead of being totally lost, is passed on from one to another of a series of chambers which are fired in succession. Most efficient of all is the tunnel kiln, through which the bricks are passed on slow-moving trolleys, entering in their green state and emerging not only burnt but cooled for handling. Continuous kilns are in growing favour among the larger makers of hand-moulded bricks, while yards retaining an intermittent kiln are likely to use the closed down-draught type, which permits better temperature control than the open-topped " Scotch " up-draught kiln still seen occasionally.

In addition to improvements in the design of the kiln itself, experiments have been carried out at the Rural Industries Bureau's clay testing station at Arborfield, Berkshire, with the use of oil fuel, and if and when this clean and controllable material again becomes plentiful it may do much to make brickyard work more attractive.

Bricks with Character Such improvements not only help to make hand-made facing bricks one of the cheapest of luxuries; they abolish some of the tedium which deters young men from a trade which has contributed much to the visible character of our towns and villages. Much of this character is derived from the colour of the brick and its association with the soil of its own county. The creamy-white of Devon or East Anglia, the blue of Staffordshire, the rust-red of Leicestershire and the midland coal counties, the browns and greys of Buckinghamshire, or the delicate pink of Hampshire and Sussex are the accumulated result of scores of thousands of patient, calculated manual acts in the small brickyards by men who have never attracted such wide esteem as the blacksmith, the thatcher or the saddler.

This perfection of the colour of the brick—leaving aside its durability or strength—needs care and watchfulness. It can be varied by the addition of iron and other oxides, by the presence of salts which create efflorescence on the surface, by the stacking of the bricks in the kiln so as to cover or expose to the flame parts of their surface, and finally by the admission of varied amounts of air in the last stages of burning.

Hand-made facing bricks, though more costly than wire-cut and other mass-produced bricks, are very highly regarded. Those unfamiliar with them can make their acquaintance at the Building Centre in London,* where, among the products of competitive modern industry they hold their own with an assurance in keeping with their ability to outlast any other man-made object.

* 26 Store Street, Tottenham Court Road, London, W.C.1.

BAIL MILKING ON A FIXED SITE

K. HILLS BOND, M.C., N.D.D.
Ministry of Agriculture, Fisheries and Food

Last October the writer dealt with the use of milking bails in the field. Here he discusses the possibilities of the bail which does duty as a milking parlour on a concreted site at the farmstead.

FOR the dairy farmer who wishes to adopt the parlour system of milking but has no building that readily lends itself to conversion, the fixed milking bail offers a practical solution. But to attempt bail milking on a fixed site which does not consist of an area of concrete is unthinkable. Such an area must, at the very least, be equal to the extent of the bail plus the working space behind it, but it can with advantage be larger. The fixed site may be at the farmstead, or some distance away in the fields. In the latter case, the reason for using a bail is more akin to the purpose in adopting the movable bail system such as was described in a previous article.* It is, however, much more common for the fixed site to be at the farmstead or close to other farm buildings, and in particular to an open or covered crew-yard.

The reasons why a dairy farmer chooses a fixed bail instead of the conventional cowshed or milking parlour for the milking of his herd, are worth examining. It cannot be said that a bail at the farmstead has any particular merit over a milking parlour, if there is a building suitably located on the farm that can serve, or be made to serve as a parlour by relatively inexpensive alterations. The farmer may, of course, wish to adopt the milking parlour system because he regards it as having advantages over milking the cows in a cowshed. Or, although he may not prefer the system for its own sake, he may be faced with heavy costs of bringing his cowsheds up to the standard required by the Milk and Dairies Regulations, and this may lead him to look for a less expensive alternative. In some cases, too, the landlord may be unwilling to undertake costly improvements to the cowsheds or to provide suitable buildings. The tenant, equally unwilling because such capital expenditure would be unwise in his position, sees in the milking bail an expedient which would make it possible for him to milk cows in conformity with the requirements of the regulations. Moreover, a bail is a piece of equipment which he can take away if his tenancy ends, or dispose of if his farming policy should change. Some farms, though suitable for bail milking in the fields in the summer months, are unsuitable for it in the winter, because of the nature of the soil or low-lying situation of the fields. Personal objections to the rigours of bail milking in the fields in winter may also be a deciding factor in having a fixed site at the farmstead to which the bail can be moved during the months of inclement weather.

Because such considerations are quite common, milking bails have increasingly become used in a way and for a purpose for which they were not originally designed. Yet experience has shown that their use need not be restricted to their original mobile purpose, and that with some slight modifications they make a useful static expedient. Such an expedient is by no means necessarily a makeshift. Bails properly installed on fixed sites have given satisfactory service over many years. Although manufacturers have their recognized designs, many milking bails are made by them to order, rather than sold "off the peg". To facilitate their being moved, bails are

* Bail Milking in the Field. K. Hills Bond. October, 1956, pp. 319-21.

made up on iron skids or have wheels set in the framework. Unless the user intends to move the bail from its fixed site to the fields, there to serve as a movable installation, the skid type is perhaps more suitable for a permanent location than one on wheels.

A Properly Drained Site Assuming that no suitable concrete area already exists, the choice of the site at the farmstead will depend on the situation of the other buildings to be used in conjunction with it, such as covered yards, the milk room and the fodder store. The site should preferably be level, but not low-lying. The need for good drainage must be taken into account. In this connection, the requirements of the Milk and Dairies Regulations must be given due weight. A proviso to Regulation 13 gives exemptions to "a milking house which is a movable shed" from the requirements of sub-paragraphs (a) and (b) of that regulation, so long as the shed is "moved with sufficient frequency to avoid contamination of the milk". Clearly, no such exemption can be claimed in respect of a milking bail on a fixed site. To all intents, a milking bail so located is a "milking house", and all the requirements of the foregoing sub-paragraphs—relating to "any building, part of a building or shed used as a milking house"—apply. Consequently, "the surface of the floor liable to soiling by cows" must be "impervious and constructed of such material and in such manner as to render it practicable to remove any liquid matter that may fall thereon". Nothing but a concreted area for the bail to stand upon is likely to satisfy that requirement. Furthermore, "the floor must be so sloped and provided with gutters or channels that will carry any liquid matter to a suitable drain, and thence to a suitable place of disposal".

A very common fault when a site is being constructed to take a milking bail is to lay the concrete to a true level. This natural tendency of the contractor must be resolutely countered by the prospective user of the bail, who must insist on an adequate slope being given. The direction of the slope in relation to the bail is an important practical consideration. There is, of course, no need to provide a dung channel along the back of the bail: indeed, this is undesirable. Different levels, with steps up or down, should be avoided. The fall of the ground and the place of disposal of the drainage will largely determine the aspect of the slope in relation to the points of the compass. A fall of one inch in five feet will give a reasonably fast run-off of water, provided the concrete is well laid and the surface even, but a slight increase in the fall helps to overcome uneven surfacing. It has also to be decided how the bail should be placed in relation to the direction of the slope. The skids will obstruct the flow of water from back to front, or vice versa, and therefore it is preferable to place the bail with its length up and down the slope.

In many instances the area concreted is not merely equal to the area needed for the bail and the working space behind it for the milkers, but is extended to provide for an assembly and a dispersal yard. It is indeed highly desirable that this should be done, otherwise the ground around the bail is likely to become very foul, and there is serious risk of contravening the regulation which prohibits any accumulation of dung on the approach and access to a milking house. The appropriate size of the assembly or collecting and dispersal yards depends, of course, on the number of animals in the herd, but a simple guide to the space needed is 25 square feet per head for dehorned cattle and about 40 square feet for horned. It is a mistake to have the yards too large, because this increases the labour of cleaning them. The yards should be stoutly fenced, and it may be worth using an electric fence to limit the area that can be fouled by the waiting cattle.

If the slope of the yards is in the same direction as that of the floor of the milking bail, the problem of disposing of the water running off the combined surfaces is simplified. A dished channel along one side with a good fall throughout its length can then discharge to what is described in the Milk and Dairies Regulations as "a suitable drain", to be carried thence to "a suitable place of disposal". When the milking house is a permanent building, it is usual to require that the drain, in order to be regarded as "suitable", shall be a catchpit of adequate dimensions or a trapped gulley. The drain for a milking bail on a fixed site need not necessarily be so constructed. Indeed, the large amount of solid matter carried by the water draining off the surface of the area, calls for a different kind of trap from that which is suitable when the water runs out of a permanent building and from which most of the solid matter has already been removed. There are several ways of separating the solid matter from the liquid, but the most common is the weir system. A fairly shallow, open sedimentation chamber with an outlet over a weir results in the liquid being carried to the place of disposal without excessive solid content. But any system requires the sedimentation, or settling, chamber to be cleaned out regularly. Moreover, the solid matter removed must be carried away—not dumped on the sides only to be washed back into the settling chamber by rain. Without regular attention, the system mur fail.

Assets at the Homestead Given a piped water supply—which is desirable on every dairy farm—the fitting of a water tap near the bail will greatly ease the task of keeping the bail and the concrete base clean. Immediate hosing down when milking is finished should not be neglected. Machine milking is practised at most bails on fixed sites, and the installation of piped water for cooling at the farmstead makes it feasible to adopt direct-to-churn milking, which is rarely practicable when a combined milking bail and dairy is used in the fields. The difficulties associated with cooling milk when bail milking is carried out in the fields are less in evidence when the bail is on a fixed site with a piped water supply to hand, and the process is thus usually carried out more efficiently.

At most farmsteads where a bail is used on a fixed site, electricity is available for power and light. When light is being installed in the bail, it is as well to make provision for the assembly yard to be lit as well. A powerful light mounted on a 20-foot post is most useful to those who are working the bail. It saves a good deal of groping about in the dark—a self-inflicted suffering on so many farms—and switching it on a few minutes before milking is due to begin serves to call up the herd when it is lying out in the fields.

The fact that the bail is not to be moved makes it possible to provide more permanent protection for the milkers against the weather than can be achieved with movable bails. The building of an extension at the back of the bail is recommended in all cases, unless its proximity to other buildings gives sufficient protection.

Of all the buildings associated with the milking bail, the dairy is the most necessary, and a bail on a fixed site usually has the advantage of being near a building that can serve in this way. A permanent building has many advantages over most movable dairies, but perhaps the greatest is that it is more commodious and that the washing-up of dairy equipment and the treatment and handling of milk can be carried out more conveniently. There is a tendency, however, to leave the milking machine clusters hanging up in the bail between milkings, instead of keeping them in the dairy. This is bad practice, as is also leaving the milk in the bail to await collection. The purpose of the dairy is not only to provide a place for washing-up utensils

and cooling of the milk, but also to protect the equipment and the milk from contamination by dust and dirt. If a movable dairy is placed on the fixed site adjacent to the bail, it should be on a concrete base and so placed that the foul water from the yards or from the floor of the bail does not flow through it.

Although some milking bails are run in conjunction with cowsheds, in which the cows lie-in during the winter months, most of them are used where the cows are out in the fields summer or winter or where the cows are kept in adjacent crew-yards. Usually the cows get their ration of concentrates as they pass through the bail, but cows that receive their concentrates when tied with multiple yokes at mangers in the yards readily adopt a routine of passing through a bail for milking only, as they do in some milking parlours. There are, in fact, few aspects of milking parlour techniques that are not applicable to a milking bail on a fixed site at the farmstead.

HIGHER AGRICULTURAL EDUCATION

PROFESSOR A. N. DUCKHAM, C.B.E., M.A.
University of Reading

Professor Duckham examines the kind of work taken up by graduates of Reading University and considers the type of training which will best equip the student to meet the growing complexities of farming.

SINCE the advent of the N.A.A.S. and the growth of independent research institutes financed by the Agricultural Research Council, the universities have become more concerned with the production of advisers and research workers than with advice and research as such. The main job of the universities is, therefore, higher education—though they must also do research in order to keep their teaching lively and to train graduates in research methods. Their primary agricultural function is to meet the future needs of the industry for professionally qualified men and women.

What are these needs likely to be—in numbers and in kind of training? The number of graduates required in the years ahead is not easy to assess, but it seems fairly certain that, in an industry of such quickly-growing complexity and in which science and engineering are playing ever-increasingly important roles, the numbers needed will be more, and not less, than the present national output of 400-450 a year.

For what kind of work are these graduates required? Perhaps the simplest way to answer this is to see what happens to graduates in agriculture, horticulture, dairying and agricultural sciences when they leave their universities. Many, of course, go to do their National Service and are lost to the "occupational" records kept by most universities. But of those who can be traced, it seems that about 40 per cent of the annual national output go into farming; 20 per cent into the N.A.A.S., the overseas civil service or other Government departments at home or in the Commonwealth; 15 per cent into commerce, mainly on the technical side; and 25 per cent go into teaching at universities, colleges and farm institutes, etc., or into research.

National details showing the kind of post taken by graduates with different kinds of degrees are not available, but Table 1 may serve as some guide. This shows the first posts taken by Reading graduates in agriculture, horti-

culture and dairying during the four years 1951-54. Similar statistics for 1956 show that, of the graduates in agriculture, 20 per cent went into National Service and will presumably return either to farming or "professional" agriculture; 17 per cent went farming as managers or on their own account; 20 per cent turned to teaching and research; 34 per cent entered the N.A.A.S. and other Government services at home or abroad; and the remaining 9 per cent went to "industry and miscellaneous".

Table 1

Analysis of First Posts Taken by Graduates of Reading University in the Four Years 1951-54

Employment	Type of Degree		
	Agriculture *per cent*	Horticulture *per cent*	Dairying *per cent*
Farming: Farmers, Managers, Bailiffs, Assistants, Further experience	40	30	18
Teaching or Research: Schools, Farm institutes, L.E.A. extension work, Colleges, Universities, Research stations	21	22	18
Government Service: N.A.A.S., Overseas civil service, Commonwealth Govt. service, National service	19	16	20
Industry and Miscellaneous: Agricultural advisers, Tea and coffee firms, Agricultural journalism, Research, Milk industry, N.F.U., etc., Milling, Sales representatives	20	24	44

Future Needs Future occupational trends are difficult to forecast, but it seems that modern science and engineering are likely to step up the demand for university graduates going into agricultural research, advisory work, teaching at agricultural colleges and farm institutes, into commerce, and into administration. It may be that the proportion of graduates going into "professional" agriculture will increase, and that those who go directly into practical farming will remain in the minority. In many ways this trend would be unfortunate, for we need more farmers with degrees—men who can become leaders in the years that lie ahead of us.

To answer the question "what kind of training is needed?", we need to hazard a look into the future; for the student coming to a university in 1957 will be only in his early forties in the 1980s and is still likely to be farming, advising or engaged in research in the first decade of the twenty-first century. Looking ahead, it seems, first, that over the next thirty years the pace of technical change—both in the biological and the physical sciences—is not likely to be less than the rate of change we have had during the agricultural revolution of the last thirty years. In particular, we must expect the newer

applied sciences, such as nuclear physics and electronics, to have a considerable impact on farming. Second, these technical changes and their economic consequences are likely to make the running of a farm even more complex than it is today. Managerial ability will be more important than ever. Third, the speed and width of technical change and the complexity of farming will, almost certainly, create a demand for more specialists of all sorts—scientists, contractors, farm management advisers, and so on.

Common Denominators Whatever shape the future takes, all agricultural graduates—whether they go into "professional" work or go farming—need certain things in common. First, they must have a deeply-rooted knowledge of the principles of their main subject—which may be agriculture, horticulture, dairying, agricultural economics, or agricultural chemistry, botany, zoology, microbiology, etc. Practices change so quickly nowadays that we must have a very firm foundation of principles to build on so that we can tackle new problems and meet new ideas as they arise.

Second, graduates must have a working knowledge of current practices, however rapidly these may be changing. For, on the one hand, the quickest way to grasp a principle is often to find out how it works in practice; on the other employers expect such knowledge. In the case of those taking straight agricultural degrees, the practical sides of crop and animal husbandry, mechanization and management must be a feature of the course; for those who intend to go into research or more specialized fields, experience of statistical method and of laboratory, field experiment or survey techniques are needed.

Third, graduates must not only achieve the arts of clear and constructive thinking and of acquiring further knowledge, but they must also be able to *use* both their professional knowledge and their capacity for constructive thought. In other words, they must be able to "get themselves across" to their staff, to their colleagues and, in many cases, to the farming public as well. They need to gain some capacity for self-expression and for leadership. Knowledge and ability to think straight are not enough. And so, if he is ultimately to play an effective part in the progress of the industry, the student must—in the future as in the past—be helped to develop character and personality.

To this end, the student needs a few hours each day not only for private reading of professional and other books and papers and for digesting what he has been taught, but for those non-academic student activities (sports, debates, or just casual talking with students of other subjects) which can do much to develop character and personality. (It can, of course, be argued that full and rigorous curricula and examination systems by themselves tend to develop orderly thinking, character, and self-expression; but the adventitious informal training is probably equally important.)

The Pattern of Formal Teaching In these days, when there is so much more to know, it is no easy task to find enough time for the formal teaching of principles and practice without encroaching too heavily on the student's "private" time. What is the pattern of this formal teaching? The curriculum varies between universities but, to judge from the end product—that is, the graduate—the differences cannot be so great in practice as they may appear to be on paper. This is partly, of course, because most universities start with roughly the same kind of intake. Most incoming students have taken two or three science subjects at Advanced level in the G.C.E., and they have either been brought up on farms or want

"a life on the land" and have done some practical farm work. At Reading, the latter predominate. For out of an intake of 108 students for agriculture, horticulture, dairying, and applied agricultural sciences (in October 1955) only 36—that is, one-third—came from farms.

Most degree courses now call for an initial or "intermediate" year devoted to pure sciences and to "background" subjects like agricultural history, before the student proceeds to the study of agricultural chemistry, botany and zoology. At the same time as the student starts on these applied sciences, he generally begins to study crop or animal husbandry. That is, he learns practical applied biology alongside his theoretical work in the applied sciences. But his studies are by no means confined to the biological side of the farming triangle. In the last twenty years the other two sides—mechanization and economics—have assumed an increasingly important place in the curriculum.

In the last few years, farm management—that is, the integration of these three sides (the biological sciences and husbandry, the engineering sciences and mechanization, and the social sciences in the form of agricultural economics) has come to the fore in agricultural and horticultural degree courses.

Some idea of how much time a typical agricultural student spends on each of these groups of subjects is given by Table 2. This shows the distribution of teaching hours for the second and third year of the Pass Degree course in Agriculture at Reading. (In his first or intermediate year the student takes elementary economics and the history of agriculture, as well as enough science subjects to bring his total science passes at Advanced G.C.E. level up to five.) It will be seen from the table that about half the teaching time (lectures and practicals) is devoted to the agricultural sciences, nearly a quarter to husbandry subjects, and the remainder to mechanization, management and agricultural economics.

Table 2

Reading University Pass Course in Agriculture: Distribution of Total Teaching Hours (Lectures and Practical) in the Second and Third Years

	hours
Crop husbandry, animal husbandry and veterinary hygiene ...	275
Agricultural botany and entomology	310
Agricultural chemistry, including animal physiology	300
Mechanization, farm buildings and surveying	150
Agricultural economics, farm operation, farm management and comparative agriculture	200
	1,235

The Problem of Specialization With the increasing specialization of science, of engineering and of advisory work (but *not*, be it noted, of farming), there is naturally some demand for more specialization in university courses. For Honours students, who usually do four instead of three years, this is generally fairly easy to organize; they specialize to some extent in their fourth and possibly in their third year. Again, some universities—for example, Cambridge, Reading, Newcastle and Leeds—provide one- or two-year post-graduate Diploma courses on specialized subjects, while, of course, the student proceeding to a higher degree—an M.Sc. or Ph.D.—concentrates on his thesis subject.

The core of the problem lies, however, in the Pass Degree student who is financed by his or her local education or other scholarship authority for no more than a three-year course. Should such a student have a chance to

specialize if he wants to or would he make a more adaptable and useful "agricultural citizen" if he took a good general degree? There is no clear-cut answer to this difficult problem. Some universities favour a "generalized" Pass Degree course; others offer a range of semi-specialized options. The trend may well prove to be towards the latter type. But, if so, it must be borne in mind that, although specialization allows the student to concentrate on his chosen subject and to have the benefit of small classes, it often leads to the fragmentation and undue dispersion of the available teaching strength.

A Good Agricultural Citizen The future demand for graduates in agricultural subjects may well grow. The majority of these graduates are likely to go into "professional" agriculture—research, advice, etc. It is to be hoped, however, that the number who take up farming, either as managers or on their own account, will not fall—though they may become a smaller proportion of the total output. The rate of technical and economic change in the next thirty or forty years—that is, in the working life of contemporary students—is likely to be at least as rapid as it has been since 1925. If they are to be able to keep up with changes in practices and not be overcome by the ever-growing complexity of farming, then graduates must be helped to attain a firm grasp of principles and to develop both flexible minds and character and personality.

These ends cannot be achieved by formal teaching alone; the adventitious informal training which is so vital a part of university life must be retained. This need to allow the student some private time is not easy to reconcile with the unceasing growth of organized knowledge. For this reason alone, earlier specialization may become inevitable, especially as the newer physical sciences and managerial problems grow in agricultural importance. It may be hoped, however, that specialization will not need to go so far that we lose the adaptability and width of interest that is the hallmark of a "good agricultural citizen".

Death of Viscount Hudson, C.H.

It is with deep regret that we record the death at the age of 70 of Lord Hudson, who was Minister of Agriculture and Fisheries from 1940 to 1945. He died on 1st February, during his annual visit to his Charter Estates, near Beatrice, Southern Rhodesia. He was M.P. for Whitehaven, Cumberland, 1924-29, and for Southport 1931-52. He was appointed a Companion of Honour in 1944, and created Viscount in 1952.

We remember him for his drive, energy and strong personality, attributes to which much of the success of British agriculture during the testing time of the war years can be ascribed, and upon which we are still building. His place of honour in our island's history has been most worthily won.

THE MINISTRY'S PUBLICATIONS

Since the list printed in the December 1956 issue of AGRICULTURE (p. 417), the undermentioned publications have been issued.

MAJOR PUBLICATIONS *Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.*

Bulletins

No. 35 The Use of Lime in Agriculture (*Revised October* 1956) 3s. 6d. (3s. 9d. by post)

No. 107 Soils and Manures for Fruit (*Revised June 1956*) 3s. 6d. (3s. 9d. by post)

No. 135 Fruit Tree Raising (*Revised October 1956*) 5s. (5s. 3d. by post)

No. 136 Watercress Cultivation (*Revised June 1956*) 2s. 6d. (2s. 9d. by post)

Other Publications

Co-operative Farms and Smallholdings with Centralized Services in Wales—Report and Accounts for 1955-56 (*New July 1956*) 3s. 6d. (3s. 8d. by post)

Food from Gardens and Allotments (*New October 1956*) 2s. 6d. (2s. 8d. by post)

Report of Proceedings under the Agricultural Wages Act, 1948—Period 1st October 1950 to 30th September 1955 (*New October 1956*) 4s. 6d. (4s. 8d. by post)

Studies in Urban Household Diets, 1944-49. Second Report of the National Food Survey Committee (*New December 1956*) 5s. 6d. (5s. 9d. by post)

LEAFLETS *Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (5d. by post) and 2d. (4d. by post) respectively.*

Advisory Leaflets

No. 68 Carrot Fly (*Revised November 1956*)
No. 164 Raspberry Beetle (*Revised October 1956*)
No. 219 Grain Weevils (*Revised December 1956*)
No. 222 Cream Cheese (*Reissued October 1956*)
No. 302 Starters for Cheese-making (*Revised November 1956*)
No. 324 Application of Sprays to Fruit Trees (*Revised December 1956*)
No. 456 Bulb Scale Mite (*New November 1956*)

Fixed Equipment of the Farm

No. 29 The Tractor Fuel Store (*New December 1956*) 8d. (10d. by post)

FREE ISSUES *Obtainable only from the Ministry (Publications), Soho Square, London, W.1.*

Farm Machinery Leaflets

No. 18 Tripods and Racks for Haymaking (*Revised November 1956*)

Miscellaneous Leaflets

Proposed Silo Subsidy (*New November 1956*)

"AGRICULTURE" INDEX

The Index to Volume LXIII will be issued with the April number.

Machines and Management The expansion of mechanization in British agriculture has been so rapid and progress so constant that there has been little opportunity to assess efficiency. There are no traditional standards upon which judgment can be based, and comparison cannot sensibly be made with other industries whose equipment, unlike that of agriculture, operates continuously throughout the year. An examination of accounts, however, shows wide variations in the "machinery and power" expenses on farms of similar size and type and indicates that substantial savings could often be made.

Economically sound mechanization depends on the proper selection of equipment and competent operation and maintenance, coupled with good overall organization. Planning must, of course, ensure the fullest possible use of machines and the most even demand upon labour throughout the whole year. The introduction of new enterprises, the modification of their size, or even omission of old ones, may be necessary to balance equipment and labour, but unless a machine can of itself produce a direct increase in output, its introduction will reduce profits if it fails to dispense completely with a unit of labour or reduce labour demand at a time when other profitable work is available.

Equipment to deal with daily tasks, feeding, milking, cleaning out, etc., probably earns as high dividends as any because of its high annual use. For this reason it deserves much more attention than is generally given to it. Transport equipment is practically in the same category since, on average, a tractor spends one-third of its life on haulage work, and the use of undersize trailers means a substantial waste of power and time. Trailers should be big enough to take the maximum load that can be hauled under good conditions. Loads can be reduced to meet difficult circumstances, but building big loads on to small trailers wastes time—and it may be dangerous.

Because the majority of the machines are single-purpose, depreciation and interest charges are high in relation to output, so high annual use and long life must be aimed at. Much can be achieved by keeping systems simple and avoiding duplication as far as possible. For example, three tractors with farmyard manure spreaders and one tractor with a foreloader make an effective team for manure handling. But if circumstances allow the job to be spread over a longer period, then one tractor with a foreloader and a farmyard manure spreader will do the work at much lower cost, mainly because less depreciation and interest are chargeable to the work.

On the operational side, most machinery is fairly well handled, but many breakdowns occur with new machines which have not been checked over and tried before being put to work. Getting to know the machine and giving it a trial run is time well spent. All too often, instruction books remain unopened until after the first major stop, and by then the damage has already been done. Seedbed preparation is often unduly expensive because primary cultivations have been badly carried out and reliance placed on rotary cultivators and discs to finish the job, and they use a great deal of power and time. A really thorough job of ploughing can save a lot in after-cultivations.

Substantial savings can be made by tandem use of implements, harrows hitched behind the corn drill, harrow section attached to plough on spring ploughing, and many others. This must not be overdone, especially on seedbeds where excessive wheel slip can do an enormous amount of damage.

Repair bills are high and expensive delays numerous where routine maintenance is not practised. The best results appear to be obtained where daily servicing is carried out at the end of the day and where there is a definite system for reporting and recording defects and breakages. The latter is

essential; without it, management is probably holding an inquest at a time when the machine should be at work.

Thorough annual cleaning down and overhauling should be done, paint and other protectives applied to prevent corrosion, and the machinery housed. Paint has another important (psychological) effect besides protection against corrosion, in that a neatly painted machine is treated with greater respect and likely to have a longer accident-free life than one which, though in equally good mechanical order, looks second-hand. No less important is the operator's opinion of the machine. If he is convinced that the tool is ideal for the job he will make the best possible use of it; if he thinks otherwise, results will be correspondingly poor.

Because of the large and sometimes unavoidably excessive amount of power available, there is often a tendency to lose that sense of urgency which is essential in a business subject to the vagaries of the weather. To get the best return from mechanization, every opportunity must be exploited to the full; the more work that is done under the right conditions, the greater will be the reward. High speed suits few farming operations, so punctuality and persistence are all-important.

Thus, the build-up of equipment and labour must fit the farm, the operators must know the machines, maintenance must be systematic and work must be planned to avoid waste of resources. If one is of greater importance than the others, it is the last; for effective operating time in the field is what counts. Idle running and unnecessary work eat into profits.

Management in the horse days was based upon generations of experience, but to make the most of today's power and machinery, full use must be made of carefully kept records. Without them, we are groping in the dark.

H. B. Huntley

World Meat The upward trend in world production and trade in meat continued in 1955 and 1956, according to the Commonwealth Economic Committee's review*, with most of the increase in beef supplies. Among the factors which have influenced the level of meat production in Commonwealth countries have been the improvement in pastures through increased use of fertilizers and the measures taken to control rabbits. Another important development affecting meat production, in Australia, has been the radical change in the pattern of land utilization, a declining trend in crop acreages being accompanied by a rise in pasture. In New Zealand, the high price levels for farm products, particularly wool, have provided capital for much greater use of fertilizers—with aerial top dressing assuming considerable significance—and for farm improvements which have led to heavier stocking on improved pastures and an upsurge in meat production. Perhaps of equal importance in the trend of production are the various measures which many governments have taken to assist meat producers and to exercise control over marketing and prices. These are discussed in an appendix to the review which includes a description of the fatstock guarantee scheme in the United Kingdom and a summary of the organization of the meat industry in the main exporting countries of New Zealand, Australia and Argentina.

The main part of the review is based on an examination of detailed statistics relating to world production, consumption, international trade, and prices for each type of meat and for live animals. Special attention is given to Commonwealth countries and to their share, as a whole, in world trade.

* *Meat, 1956.* Commonwealth Economic Committee. Obtainable from the Committee at 2 Queen Anne's Gate Buildings, London, S.W.1, from H.M. Stationery Office, or through any bookseller, price *5s.* (*5s. 7d.* by post).

Farm and Forest: 24. Co-operative Forestry

Private woodland owners are making a substantial contribution to the country's large-scale forest programme. Forestry, however, calls for the employment of plant and machinery and a skilled labour force, all of which are sometimes beyond the resources of the smaller owners. Since the war, however, co-operative associations of private forestry owners have been formed, and now, more than ever before, owners with a few acres of scrub woodland are finding it possible to embark on programmes of re-afforestation. The Forestry Commissioners have given their support to the development of these co-operative schemes and the progress made so far has been encouraging.

Scotland is now well served by the Co-operative Forestry Society (Scotland) Ltd. This body has flourished and expanded rapidly since it was reconstituted after the war. In England and Wales the co-operative movement has developed more slowly, but nevertheless the three main bodies in England, the Northern Forest Products Ltd., the Western Woodlands Owners Ltd., and the South-Western Woodlands Association Ltd., provide services in each case ranging over several counties, and other associations are gaining support elsewhere. In Wales, development has been hampered by difficult terrain and a multiplicity of small landowners, but here again good progress has been achieved. Dovey Woodlands Ltd., operating around Machynlleth, is very well known, while four other societies are working with promise in Flintshire, Montgomeryshire, Carmarthenshire and Breconshire.

Each of these organizations employs well-trained forest staffs and, with their own labour or by selected contractors, carries out forest operations for members under skilled supervision on a repayment basis at economic cost. The managers advise members on the proper management of their woods, and owners are finding assistance especially valuable in the preparation of the working plans required to qualify for grant aid under the Forestry Commission's Dedication or Approved Woodlands schemes. There are also, of course, the benefits to be derived from the bulk purchasing of stores and plants, and from facilities provided for competitive marketing of all classes of produce from the woodlands.

The societies are financed initially by members' capital share contributions according to the acreage to be served, and also in some cases by annual subscriptions. The Forestry Commission has assisted several of these organizations with financial aid during the early formative years.

Co-operation is indeed serving forestry well, not least because it is promoting a permanent doctrine of sound forest management among an important section of the rural community.

At the Farmers' Club
SHEEP ON THE MIXED FARM

The recent reawakening of interest in sheep as a profitable side-line to dairying and certain other farming enterprises was the theme of Mr. W. R. Seward's paper to the Farmers' Club on February 6th. Sheep, alone of all farm livestock, are fewer than before the war. In East Anglia, once famous for its huge flocks of hurdled sheep, only the ram breeders and a few winter fatteners follow the traditional folding system, once thought to be essential to farming on light land. Mr. Seward came to the Farmers' Club "not as an expert", or to tell members how to manage and shepherd their flocks, but to give an account of what they do at Chadacre Farm Institute in Suffolk, of which he is Principal, and to talk round the subject.

What he advocates in East Anglia and similar places is a hundred thrifty ewes on a 300 acre farm, run with no extra labour and very little expense,

but in addition to existing production and not as a substitute for any part of it.

"The annual depreciation on a £10 ewe", said Mr. Seward, "is more than covered by the value of her wool, so the annual cost is nil. The lamb crop on clean ground is at least 160 per cent, which at six guineas per fat lamb is over £10 per ewe. The extra £1,000 a year gross income, which results from the introduction of 100 ewes, makes *all* the difference."

Mutton is of only minor interest, continued the speaker. Lamb is the main object, and New Zealand imported lamb is the challenge. In the existing market, our objective may therefore be the production of light-weight lambs at competitive prices, from small flocks of suitable ewes, making use of the by-products and leys of a mixed farm. We should avoid disease by taking notice of veterinary research and of the almost forgotten sheep-lore; by employing part-time shepherding, new dips, the electric fence, and other labour-saving devices.

After referring briefly to the choice of ewe, Mr. Seward spoke of rams. In his view, the door is wide open for the Southdown to predominate as the sire of quality lamb—but not the miniature swaddling type which has difficulty in settling its ewes, but the active commercial sheep already being produced by many breeders.

One hundred Kerry Hill ewes are run at Chadacre, and full veterinary precautions are taken when they arrive on the farm. After tupping, they are kept hard until January 1st; there is no advantage in increasing body weight during that period. In January the ewes are taught to eat silage; hay is an alternative, but it must be of first-rate quality, and a few mangolds in addition are appreciated. In mid-February there is trough-feeding with ½ lb of concentrates a day—mixed grass or lucerne cubes, crushed oats and sugar beet pulp.

In March, the Chadacre lambing field is a ley, closed up the previous September and fertilized then. A load of straw is tipped into the field and surrounded by sheep netting; a dozen thatched cubby-holes and a catching pen are constructed. When lambing begins the ewes are shut up at dark and visited several times during the night. Light can be provided when required by the headlamps of a car.

The nursery field is a paddock alongside, or a couple of acres netted-off in the lambing field. After lambing, the ewes are moved on to the wheats or summer grass. They get 1 lb of concentrates for a short time, and often a supplement of mangolds.

"There is always jealousy over the early bite," said Mr. Seward, "and the dairy herd usually wins from the silorator and the ewes and the lambs, in that order. In my opinion, no dairy cow should be allowed to tread an expensive ley until almost May; Italian or S.22 ryegrass will serve her needs, and however much she poaches it, it can be harrowed over for a cut of silage. There is too much silage attempted in May. I like to set half of it back a fortnight by running the ewes and the lambs lightly over it; nothing will pay so well."

At Chadacre there are usually ten or twenty acres of white clover for seed, which needs grazing hard until nearly mid-June. Ewes do well here, controlled by electric fencing.

In conclusion, Mr. Seward referred to the fertility which sheep accumulate. "Their golden hoof reputation arose in the days of few artificials and plenty of oil cake," he said, "but the clover leys with which they are now associated do every bit as much good."

IN BRIEF

Preventing Twin Lamb Disease

"A hard road, a good sheep dog and a supply of oats soaked in cod liver oil and sprinkled with molasses is all that is needed to prevent twin lamb disease," said Mr. James Baker, nutrition expert, at a recent meeting of the Wells National Farmers' Union. "The object of the exercise is to prevent in-lamb ewes from settling into that state of boredom and *ennui* which is only one step from twin lamb disease and only two steps from ovine eternity! It must also prevent constipation, which is a feature of the condition. If you get the sheep on a hard road they will all dung—that's a physiological phenomenon. Secondly, the dog, which should be a quiet one, will wake them up and keep them alert and on their toes. Finally a mixture of crushed oats, molasses and cod liver oil is highly appetizing and will stimulate the ewes' interest in eating. Both molasses and cod liver oil help to prevent constipation."

Mr. Baker also suggested far wider use of trough feeding for ewes, as well as lambs. A mixture of 1 part cracked beans or peas and 3 parts crushed oats with 1 pint cod liver oil per cwt gives excellent results.

For in-lamb ewes Mr. Baker suggested a mixture of 2½ parts crushed oats, 1 part cracked peas or beans, ¼ part molasses, with 1 pint cod liver oil, per cwt. Breeders should start feeding this mixture half-way through pregnancy at the latest, allowing ½ lb per sheep per day, gradually working up to 1 lb per head in the last 2-3 weeks before lambing. For backward ewes and for the biggest breeds, this allowance could be increased still further, Mr. Baker concluded.

S S S

Swath Harvesting

Swath harvesting of oats has many advantages over sheafing or direct combining. It is possible to cut the crop at, or even before, the binder-ripe stage, and, on a properly constructed swath, it matures quickly and dries rapidly after rain. Thereafter it is picked up with a combine-harvester. The most suitable swath is formed from a cutting width of 5 feet and can be made with a modified binder. Two swaths lying side by side, each from a cutting width of 5½ feet behave in the same way as the 5-foot swath and have a higher rate of drying than a single 11-foot swath. Stubble height should be slightly greater than for sheafing. Ripening in the swath as indicated by the loss of internal moisture occurs over several days under a wide range of weather conditions.

M. Robertson, *Journal of Agricultural Engineering, Vol. 2, No. 1*

S S S

Black Currant Gall Mite

A thorough spraying with lime sulphur in early spring, as soon as the flower trusses appear but before the flowers actually open, should give a satisfactory control on moderately affected bushes. This is known as the "grape" stage. Baldwin and Wellington XXX are among the earlier varieties requiring first treatment. Select a warm, open day if you can.

IN BRIEF

Return of the Dust Bowl

Many parts of the South and South-Western Plains of the U.S. are entering their seventh year of continuous drought. Half a million acres are affected, covering 700 counties in 15 States. One hundred thousand people are now on relief, while 235 of its 254 counties have been declared disaster areas. In many places farmers are leaving to find employment in the cities; in Kansas two-thirds of the established farmers have had to seek other means of livelihood. In Texas 60,000 families have left their farms but many others have remained, but travel 100-150 miles to the cities to work.

Of the 15 States suffering from drought, the five most severely affected are Texas, Kansas, Oklahoma, Nebraska and Missouri. . . . In Texas the wheat acreage sown is only half the average of the past ten years and it is doubtful how much of the crop will be harvested. Cattle which depend on the crops and grass for their fodder have been just as badly affected. In Texas nine-tenths of the pasture land has less than one-third of its normal supply of feed. Under present conditions, it takes six times the normal area of pasture to keep a cow on bare subsistence. In the coming summer, unless the weather breaks, there is a prospect of severe dust storms, which will lead to further soil erosion.

Financial Times

Food Value of Nardus

White bent (*Nardus stricta*) is dominant in, or forms a large part of, the ground cover of nearly a quarter of the rough grazing in England and Wales. It tends to encroach on heather when burning has been neglected or where heather seedlings have been destroyed by intensive grazing.

It is generally believed that its nutritive value is very low, but a recent review of investigations on this grass points to the conclusion that it is not without value to stock, particularly in spring and early summer. There is no doubt that it is fairly heavily grazed in spring. This indication of its food value is supported by protein and digestibility figures, for in June the dry matter may contain as much as 16 per cent of crude protein with a digestibility coefficient of nearly 60 per cent. Since white bent probably remains uneaten for at least half the year, it should be considered, like a number of other moorland plants, purely as a seasonal food.

A species that occupies so large an area of our rough grazings must, in spite of its limited food value, be regarded as useful. Whilst the present tendency for it to increase is undesirable, it must be remembered that limited amounts on a mixed moor may provide feed at times of the year when most moorland species are unproductive.

Export of Live Cattle

A Committee to inquire into the export of live cattle to the Continent has been appointed by the Minister of Agriculture and the Secretary of State for Scotland. The Chairman will be Lord Balfour of Burleigh, and other members Lady Tweedsmuir, M.P., Mr. A. J. Champion, M.P., Mr. G. N. Gould, M.R.C.V.S. and Mr. Clyde Higgs, M.C.

In the meanwhile an Order has been made requiring cattle to be rested for ten hours and to be provided with food and water at or near the place of embarkation.

Tomatoes under Plastic

American scientists say that tomato plots covered with black polyethylene sheets have yielded up to 14 tons per acre, compared with only 8 tons from ordinary plots. This is called " plastic mulching " and consists in cutting the sheets into strips 4 feet wide, making holes for the plants to grow through and centring the sheet over the rows. Paths 3 feet wide are provided between the plastic-covered rows.

The higher yields obtained appear to be due to a combination of—less competition from weeds, moisture conservation and possibly warmer soil.

Cattle Bank

The Government of Northern Rhodesia has set up a bank in which the currency will consist of cattle instead of paper money. The capital consists of 2,000 head of young cows and heifers. Farmers who want to build up their herds will be able to borrow stock from the bank for a period up to five years. No fees will be charged, but interest (which will be paid in cattle, not cash) will be at the rate of 2 per cent a year. Thus a farmer borrowing 50 head of cattle for five years will have to return the original loan of 50 cattle, plus 5 head of cattle as interest.

Cattle borrowed from the bank may not be sold during the period of loan. When the loan is repaid it must be cattle of the same breed, condition and age of those in the original loan.

Higher Profit per Cow

The rising figures of milk production are the outward and visible signs of a dynamic, progressive dairying industry. We should be proud of them and do a great deal more to tell the public how jolly lucky they are to have a milk industry so enthused with the spirit of enterprise.

Although a fraction of the increase may be due to the unprofitability of beef, the main increase arises from higher yields per cow, better management of grassland, improved cowmanship, and better organization all round.

This must reduce production costs, although unfortunately the results are masked because other costs beyond our control, from wages to the cost of udder cloths, continually rise. Other costs can still be reduced, however, and the more progressive farmers are reducing them.

Figures for a number of farms in the East Midlands recently collected showed an average net profit of £27 per cow. They also showed an average expenditure of over £40 per cow on bought concentrates.

It is possible to mix for oneself a perfectly good concentrate at not more than £30 per ton. An 800-gallon cow should be able to get by on not more than two-thirds of a ton of cake a year, given good pasture, silage, kale and so on. Some are managing on half a ton.

In this direction alone, therefore, average profit per cow on the above figures could be raised by over 60 per cent and in some cases doubled.

Laurence Easterbrook, writing in
The British Farmer

Nothing to Worry About

A study made by the Louisiana State University School of Medicine has shown that farmers suffer less from headaches than any other members of the community. *Verb sap.!*

BOOK REVIEWS

A. A. McGuckian: A Memorial Volume. Edited by PROF. A. E. MUSKETT. The McGuckian Memorial Committee, Bryson House, Bedford Street, Belfast. 21*s*.

To many, McGuckian is the name of an advanced type of piggery rather than that of an Irish farmer who died in 1952. But the length of the subscription list to this memorial volume shows how much the farming community of Northern Ireland appreciated " Sandy " McGuckian.

The McGuckian Memorial Committee, consisting of his friends and collaborators, with Professor A. E. Muskett as chairman and editor, have published a tribute to him after his own heart. The brevity of his life history would please his modesty; the diversity of the other contents would suit his broadness of interest; and their readable but practical science would satisfy his desire " to spread the gospel of better farming ".

The inclusion of some of McGuckian's own lectures and broadcasts under the title *Towards Better Farming*, and, particularly, his lecture *Housing for Health in Pig Production*, shows how, by studying happenings on his own farm, he sought out and found the basic requirements of pigs. These he then satisfied as simply as possible: the pigs' need for warmth led to the draughtless, dry, insulated " bedrooms "; their susceptibility to disease resulted in the isolation of the small groups of pigs in the McGuckian piggery and his enthusiasm for outdoor rearing. McGuckian always made a point of seeking the best scientific advice and, therefore, it would have pleased him to know that such specialists of international repute as H. Clausen, E. J. Sheehy and H. G. Lamont have written chapters on the improvement, feeding, and housing of pigs.

The memorial essay, *The Potential Output from Grassland*, written by P. A. Linehan and J. Lowe of the Field Botany Division of the Ministry of Agriculture, Northern Ireland, is an excellent summary of the present state of knowledge of the science and art of grassland production and management, and it includes previously unpublished data and a useful list of references. Perhaps the interim results of the new work at Crom and Carryduff, which suggest that the suppression of clovers by quite moderate nitrogenous dressings destroys the cheapest source of dry matter in a pasture, may not have complete application elsewhere. It is a problem for further investigation by scientists and farmers who follow in Sandy McGuckian's footsteps.

This well-illustrated volume, an unusual tribute to an outstanding farmer, is dedicated to young farmers everywhere. It could be read by " young " farmers of any age, for their inspiration and advantage.

J.E.C.

Wye College Department of Hop Research Annual Report, 1955. 5*s*.

As well as the usual review of research work in progress, this year's enlarged report contains a number of contributions on special subjects—the most notable being plant breeding. Points of immediate interest to hop-growers have been summarized in an excellent leaflet (included with the report), which should encourage the lay reader to study the report itself more closely.

An account is given of an outbreak of Progressive Verticillium Wilt in one of the College hop gardens. The manner in which this was dealt with is worthy of the attention of all growers as an example that could well be followed in any new outbreak of this most devastating disease.

Numerous attempts to grow hops in grass sward have been made in recent years, and a comprehensive summary of results leaves no doubt that further critical work is required on this subject. The main conclusions so far are that ryegrass and/or cocksfoot are undesirable but that, under suitable management, timothy (S.50) and white clover have given satisfactory results. Method and time of application, as well as quantity of nitrogen, cannot be based on traditional methods, and it has been found that bad weather affects hops in grass more than those grown under cultivated conditions.

The number of hop-picking machines in use is fast increasing, but an analysis of samples picked by hand and by machine shows a considerable loss of resin in the machine-picked samples. It is not possible from the two-year survey described in this report to relate the loss to increased cone breakage, since the whole hop suffers during picking and drying. The causes of this loss will need to be carefully considered by both grower and manufacturer.

Downy Mildew has become increasingly more serious during recent years in Fuggle as well as in Goldings. It is welcome news that fundamental research has been re-started on this disease and that new materials for its control are under test.

Copies of this report may be obtained from the Secretary, Wye College, near Ashford, Kent.

G.P.C.

Features of Evolution in the Flowering Plants. RONALD GOOD. Longmans, Green. 30*s*.

Specialization in botany has tended to obscure wider problems by intensifying interest in the minor ones. And many botanists, finding that so little can be said with certainty on a topic such as that dealt with in Prof. Good's latest book, make no contribution to the philosophy of botany at all. Prof. Good has brought together a very large number of those features of the flowering plants for the origin of which any acceptable theory of evolution must provide a unified account, and he has used them in criticizing current theories.

The introduction is followed by two comparative chapters: the first on plants and animals, the second on monocotyledons and dicotyledons. These lead into the factual nucleus of the book. Three chapters review the flowering plants generally, and their two great groups separately. The plants are grouped into "biological" aggregates and the ninety-four full-page figures by Miss M. E. Malins, which illustrate examples of each of these, make a striking contribution to the book. These aggregates form the "stars" in two diagrammatic "galaxies" which symbolize those opinions of their phylogenetic affinities favoured by the author.

The special evolutionary problems of the Asclepiadaceae are summarized in two chapters and, after a general chapter on floral aggregation and pseudanthy, the next deals with the special example of the Compositae. The chapter entitled *Repetition and Superficial Resemblance* is a discussion of parallelism, which is rather difficult to understand but is enhanced by numerous examples; this is followed by a final chapter of conclusions. Much here is contentious and I find it hard to accept that the argument of the last few pages, for example, is an unbiased analysis. The conclusions may be valid but there are unresolved difficulties against their acceptance in the form in which they are stated. There are relevant, mainly genetical, facts which have been neglected, and the author does not make his presuppositions explicit. In short, the reader must be careful to detect and criticize the generalizations. Although this is true of all works on controversial subjects, it is questionable whether the scope of this book is wide enough to sustain the author's strong reaction from the traditional doctrine of natural selection, welcome as that reaction may be in itself.

Notwithstanding what has been said, this book is worth reading for the mass of facts that are presented, often in a novel and interesting way. The index is excellent and makes this a specialized reference work at not too high a price. As a summary of knowledge of the flowering plants, it is naturally compressed beyond the needs of the student, but even he will find the bird's-eye-view it gives stimulating.

J.L.

Breeding Cows for Milk. A. LUDLOW-HEWITT. The British Publishing Co. 10*s*.

Mr. Ludlow-Hewitt, the owner of a Shorthorn herd, decided to use Friesian bulls to bring the herd up to full pedigree status. In this book he gives an account of his observations during this lengthy grading-up. The yields at present being attained from the herd show that it is a success story and so the remarks made deserve attention. As the author points out, the housewife is not interested in the fanciful appearance of cows but in the price of milk. He is insistent throughout that, for this purpose, good milk ancestry and not appearance in bulls is required. Consequently, bull licensing comes in for quite a lot of criticism; many of his best bulls were bought unseen after very careful consideration of their milk ancestry. Methods of feeding, including the use of grass and kale, management and cowmanship are also discussed.

A few of Mr. Ludlow-Hewitt's remarks would be frowned upon by the scientists, as when he says that a bull does not get such good stock late as early in life, and that it is the shock of the injection stopping the milk secretion, and not the calcium, which cures milk fever. But on the whole his ideas are sound in practice.

With a number of short chapters, appropriate quotations from the poets and the pioneer breeders, and something of the natural history of the cow, the book makes pleasant reading.

J.H.

BOOK REVIEWS

Oats: Their Cultivation and Use from Ancient Times to the Present Day. WILLIAM M. FINDLAY. Oliver and Boyd. 21*s.*

It is told of William Findlay—whether apocryphally or otherwise—that one day, as he was walking with a friend, they caught a side view of an isolated shorn sheep. "Ah," commented the friend, "I see Mr. Brown has shorn his sheep." "Well," said Findlay, "on *one* side anyway." Such was the passion of the man for acute observation and accurate deduction—faculties which are well to the fore in this easily-read book. Its title is, perhaps, a little too ambitious, because it is much more an account of practical oat husbandry in north-east Scotland than its name implies. On the other hand, the historical matter is broadly based and rests on much scholarly reading.

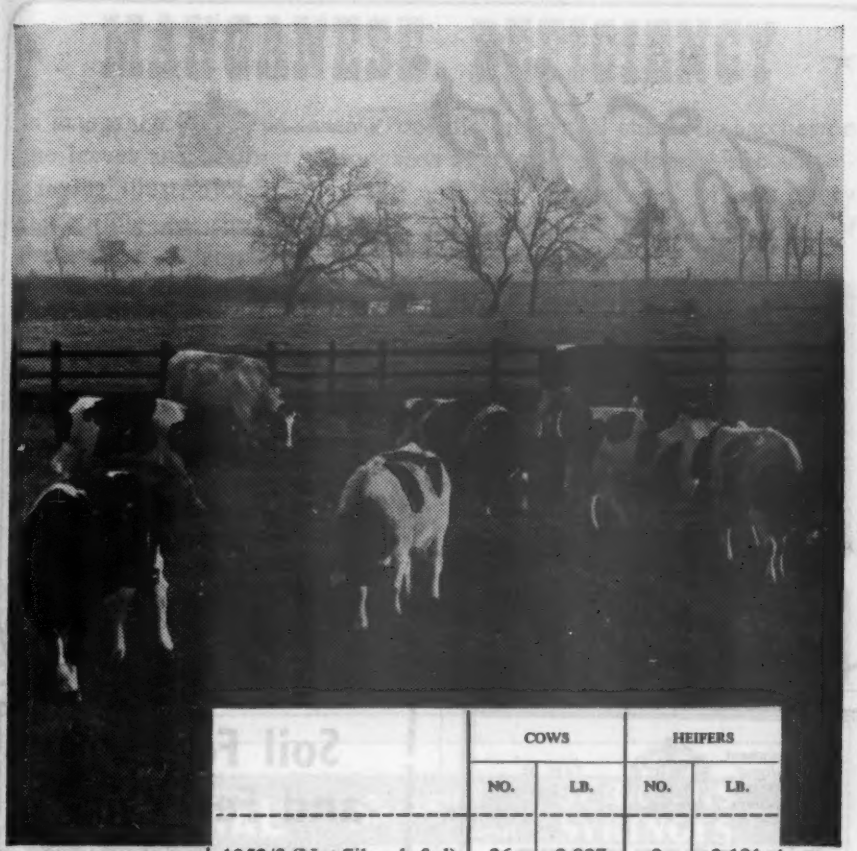
The book offers little to the plant genetist or plant pathologist, as no doubt its modest author would have been eager to make clear; the chapter on pests and diseases is cursory and the section on weed control might well be deleted from future editions as being rather extraneous and already inevitably inadequate. It is in the chapters on varieties, manurial treatments and cultural methods—the author's special field of study for so long—that the book really lives and provides an invaluable record of the major work carried out in Britain. Here there is a wealth of detail essential both to farmers and students, on size and weight of grain (most people have now forgotten the real reason for the importance of heavy, well-graded seed and imagine it to be a form of presentation to catch the eye), time of sowing, standing power, and rate of sowing. The importance of lime to oats—a crop so often regarded as an excuse for ignoring the pH status of the soil—is well documented. And how slow we have been to make adequate use of Findlay's figures which show so clearly that nitrogen is ready to contribute proportionately more to the yields of grain and straw than either phosphate or potash.

Small farmers who sow cereals by broadcasting will be interested to read that, if the phosphate is also broadcast, their results will be equal to those which their more affluent neighbours achieve by using "combined" drills for fertilizer placement. The author stresses that the feeding value of oat straw drops when cutting is delayed to the point of full ripeness, as in combine harvesting, but there seems to be little evidence of this unless the comparison is with oats cut considerably before the stage of binder ripeness. Moreover, palatability is the key to the nutritive value of cereal straw. Some interesting data on the composition of oat straw are also given, showing that, contrary to general belief, there is no significant difference between the feeding value of straw of the newer, shorter, stiffer, grain-producing varieties and that of the older straw-producers. There is evidence that the west side of Britain can justify its claim to produce straw of a higher feeding value.

As Dr. Fraser says so feelingly in his preface, Findlay was a great man. This book makes a fitting epitaph for one of the last agricultural scientists who was first and foremost a farmer and who could, and did, do both jobs well.

D.S.H.

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE by Billing and Sons Limited, Guildford and London.



Customer:
Messrs. R. & J. Rutherford,
Owton Fence Farm,
Greatham, West Hartlepool.

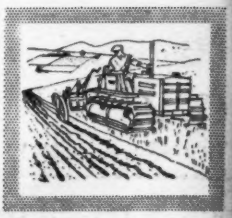
Breed: Friesian.

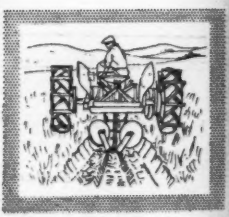
	COWS		HEIFERS	
	NO.	LB.	NO.	LB.
1952/3 (Not Silcock-fed)	26	9,097	9	9,121
1953/4 (Silcock-fed)	**22**	**9,747**	**11**	**9,296**
1954/5 (Silcock-fed)	**20**	**10,829**	**21**	**10,503**
1955/6 (Silcock-fed)	**31**	**11,300**	**13**	**13,420**

SILCOCKS
Proof of the feeding

Here is yet further evidence of the remarkable effect H.Y. has upon yields. Eleven of the heifers, some of which are shown in our photograph, were got by one bull and averaged 14,229 lb. apiece in 309 days at 3.63% butterfat.

R. Silcock & Sons Ltd., Stanley Hall, Edmund Street, Liverpool 3





Profit from the hill

The uplands may be picturesque, but they are difficult and costly to farm. Wet, cold and acid. Yet in Britain there are over forty thousand holdings on the hill, amounting to 31% of our total agricultural acreage.

The Hill Farming Act has made practicable the long-term reclamation and improvement of such land. Today, with careful management—including the use of fertilizers—some of the most unproductive land can be made to yield a profit. Much of the work done by I.C.I. is directly helping the hill farmer. For example, the importance of nitrogen as a means of extending the effective grazing season, and of increasing the production of grass for winter feed, is becoming widely recognised. By research into these fundamental problems of farm management, in all conditions, I.C.I. is contributing to increased yields and an ever-growing profit from the hill.

ICI **FOR AGRICULTURE**

E

1-3-57